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Electricity Supply Development.

IT was most fitting that those concerned in the operations of the British Electrical Development Association should rejoice together at the annual gathering over the measure of success that attended the efforts put forth during an extremely busy year. The Wembley "Electrical Service" demonstration marks 1925 as the year of the Association's biggest venture. It was on the whole most efficiently run and the expenditure incurred was by no means excessive. The industry cannot fail to derive business for some time to come from the investment of £33,000 thereupon. This outlay, it has to be remembered, was over and above that incurred for the Association's normal operations, and it was made at a time when all electrical manufacturing concerns were spending heavily upon their own separate exhibits. Yet when we consider how vast is the capital invested in electricity supply and all other branches of the electrical industry, the sum mentioned looks remarkably small; and when one contemplates the greatness of the opportunity for immediate development, it becomes quite insignificant. We have no hesitation in saying that the situation warrants an annual expenditure in a normal year, if there can be such a thing with electrical affairs constantly advancing, of more than the total of the past exceptional year. We trust that as the result of decisions arrived at last Friday, the E.D.A. finances will be put upon a firmer basis altogether, so that its activities may be extended in many necessary directions.

If, therefore, we confess to feelings of disappointment on leaving the luncheon gathering which followed last Friday's meeting at the Hotel Cecil, it must not be imagined that we in any way undervalue the achievements of the Association, which reflect the greatest credit on the Director, Mr. J. W. Beauchamp, and his staff. Our regret is limited purely to the lukewarm character of proceedings which should have been full of spirit and of fire.

While it is perfectly true that preaching to the converted requires less forceful speech or persuasive eloquence than an appeal intended to impress the unconvinced, it sometimes happens that into the select assembly some unconverted may have found their way while even the blameless are lacking in enthusiasm and vision.

Perhaps the eloquence was exhausted in the private meeting of the morning, which ought to have been a time for most cordial and complete enthusiasm—certainly there appeared to be very little left over for the luncheon gathering when a number of outsiders were present. Yet, considered from the standpoint of popular appeal and general public interest, the luncheon speeches were the more important if for no other reason than because many representatives of newspapers were present who reach the eye and ear of the general public. One wonders whether the E.D.A. organisation has yet been able to bring its influence to bear upon newspaper editors and journalists. It can hardly be expected that the case for electrical advance will be properly advocated in the popular Press unless those who write for it have first learned the lesson. From our own personal experience and observation we judge that to many non-technical newspaper men throughout the country the merits of electrical service are practically unknown, while the minds of some of them have not been left unaffected by enterprising gas propaganda. Such functions as that of last Friday, when twenty or thirty newspapers were represented, might have been used for making a forceful appeal to the imagination of the outsider.

The Association has now completed the first five years of its existence; its value to the industry has been established beyond all question, and the next step is obviously to make the best possible use of it: to extend the scope of its operations and to increase its output. That, of course, implies increased expenditure on the part of the Association. It has been pointed out that every supply undertaking already spends a greater or less amount of money on publicity; and that money spent by the Association brings a far greater return than the same amount of money spent on similar work by individual undertakings. It has been suggested that by diverting to E.D.A. a portion of the allocation, the undertaking will make a better bargain and the Association will be equipped with the necessary revenue. There is nothing new in this policy, which is indeed a commonplace of co-operative business, and we trust that electricity committees and boards of directors will realise that by thus helping E.D.A. they are helping themselves still more, and helping the industry as a whole. But we would go further than to suggest the diversion of a part of the expenditure to E.D.A. if such a course means a restriction of specialised local activity. There are few undertakings in the country that are spending nearly as much as they should do on development efforts. Most should be able to co-operate with the Association in addition to conducting part of their own operations. The need is that they should increase their allocations and earmark a part for the purpose of profitable co-operation. Effective central propaganda and organisation should transmit an electrical influence to all parts of the land. It might even catch within its whirl those unenterprising concerns which we are told are deliberately turning down cooking and other domestic load. Like Mercy, a really powerful movement might bless both him that gives and him that takes a supply of electricity.

It does not appear to be generally realised how abundant and immediate is the return produced by an effective campaign amongst domestic potential users of electricity, though we have from time to time cited instances of successful results. During the war the great demand was for power supply, and since its close much attention has been given to replacing the power load which was lost at the Armistice; but station managers who have concentrated upon the domestic load and have taken active steps to approach householders—instead of waiting, as so many do, for the latter to appeal to them—have been astonished at the eagerness with which their representatives have been greeted. It is well known that E.D.A. is preparing plans for redoubling its efforts to develop the supply industry, and the Electricity Commission is marshalling forces with the same purpose in view; we feel sure, therefore, that undertakings throughout the country will be well advised in greatly increasing their contributions to the funds at the disposal of the Association. It has accomplished splendid work with the small income hitherto entrusted to it; we can set no limit to what it will achieve when it is equipped with funds more nearly in proportion to the vast turnover of the industry.

In the speech delivered by Sir George Sutton, Bart., the new president, some suggestions were dropped which will stimulate thought. He mentioned that electricity authorities who were not able or disposed to concentrate on the selling side should permit E.D.A. to do this for them. The engineers, especially in the case of smaller undertakings, may not have sufficient time, whether or not they have the ability, to devote to spirited commercial development. Sir George's suggestion may have been intended to relate to publicity, advertising and local exhibition co-operation, but the terms in which he made it lead us to wonder whether the electrical situation would not warrant a departure from the beaten path and a widening of the scope of E.D.A.'s activities. The words "concentrating on sales" as used conjure up before us something more than publicity and propaganda. These there must be, while local exhibitions in which specialised central and local knowledge are brought into close working co-operation, should be arranged in conjunction with such efforts. But what about a far more sweeping measure—concentrating on actual "sales" or definite business-getting? We throw out the idea for what it may be worth—why not place E.D.A. in such a position that it will have a staff of expert canvassers who will set towns electrically ablaze one after the other by a week or ten days' house-to-house campaign? Concentrate upon one town at a time—then pass on to the next, leaving somebody behind to gather up the fruits of the great electrical revival efforts! Mr. Frank Gill asked whether something could not be done to "light the electrical torch so as to set fire to the place." Is this not one way in which that could be accomplished? Choose a dozen or so towns so placed that the influence from each, as it was covered by the peripatetic staff, would spread through every intervening place. The torch is only smouldering at present—let it be well lighted and blaze away, fed by the spirit of imagination and really aggressive enterprise.

Conditions in Sweden.

The report by Mr. H. Kershaw, O.B.E., Commercial Secretary to the British Legation at Stockholm, which we review in this issue, shows that in a number of respects conditions in Sweden are very similar to those prevailing in this country.

This is particularly marked in the Swedish engineering industry, which, like our own, is dependent to a large extent upon export trade. It is recognised there as here, that in comparison with the sheltered industries, *e.g.*, the building trades, wages are too low. Unfortunately the pressure of foreign competition compels them to remain low, and, further, leads to continued efforts towards more efficient production.

In another direction, however, conditions in the two countries are considerably at variance. In Sweden 40 per cent. of the arable land is now provided with electricity, whereas in this country we have hardly begun to talk about percentages in this connection. A useful load of 260,000 kW has been built up and 120

million kWh is consumed annually. Another matter of interest mentioned in the report is broadcasting, and it is certainly gratifying to learn that the bulk of the receiving apparatus imported during the short time in which broadcasting has been in vogue has been British. The market is likely to expand rapidly, and such an introduction should lead to increased business for our radio apparatus manufacturers.

Although Sweden is now a highly-developed industrial country, there is still room for British products, as witness the use of British material in railway electrification, and the tariff obstacle, which is encountered in so many countries, is not so pronounced in Sweden.

Trade with China.

THE prospects of British trade with China formed the subject of an address recently delivered at a dinner of the Old Colony Club in London but, judging from a newspaper report, it contained little information of immediate practical value to the British manufacturer anxious to develop our electrical trade there. Mr. Archibald Rose, late Commercial Attaché at Shanghai and Peking, was the speaker, and before such a gathering his remarks would naturally be general rather than particular. Even the most casual student of Far Eastern affairs is familiar with the continuous internecine struggle which has been the outstanding fact in China for many years. Mr. Rose remarked that these recurring upheavals are part of one long and still unfinished struggle among the provinces, as they seek to evolve some form of national government. One might write pages on the subject without being of the least assistance to electrical traders, so we forbear. Yet it is interesting to note that in the lulls between the various phases of the evolution, opportunity occurs for constructive work which will ultimately bear fruit and may even yield a certain amount of immediate business. The speaker showed that throughout the interior a very efficient collection and distribution system is being gradually built up which is raising the standard of living and increasing the real wealth of the country.

This interior activity is of special interest because it is understood that the future development of trade is largely dependent upon healthy development there. There is a growing interest on the part of the Chinese themselves in big commercial and industrial issues, and British electrical interests will find it profitable to bear this in mind and adopt a policy of co-operation with them as the more hopeful means for making progress.

"Self-Help" for Trade.

THE discussion on the means to be employed for obviating bad debts in the course of foreign trade, which has been alluded to on several occasions in these pages, found its way into the recent annual meeting of the Association of British Chambers of Commerce. The mover of a resolution on the subject urged his hearers to make a study of the great mutual scheme which has been evolved by American exporters for helping themselves, and Mr. A. M. Samuel, the Parliamentary Secretary for Overseas Trade, mentioned that the Government had prepared its questionnaire in order to collect the facts so that traders knowing therefrom just what the situation was, might devise their own methods for dealing with it. He went on to say that while bankers could hardly be expected to lock up their money for two or three years because a foreign debtor could not pay, it might be possible for traders to attach to their bills insurance policies issued by insurance companies, thus keeping their bills clean and increasing the disposition of the bankers, finance houses, and others to find the money. Mr. Samuel did not regard the matter as one for Government interference or assistance beyond the investigation province indicated. He suggested that traders should approach their own insurance companies, and added that such accommodation would, of course, have to be paid for, inasmuch as they could not expect to have omelettes without eggs. The Government policy of self-help for industry was further outlined by Sir Philip Cunliffe-Lister at the annual dinner of the Association. The Inter-Imperial development of trade, the development of new markets and the stimulation of a common endeavour were among the familiar points mentioned, after which it was emphatically intimated that while the Government would do its utmost to help industry to help itself, it must not be asked to do the trader's own job. "The country has to save itself by its own exertions, and, if it does, it will save the rest of the world by its example." The Government, through the Chancellor of the Exchequer, has an excellent opportunity of helping industry to help itself by relieving it of part of its terrible taxation handicap.

National Electric Power.

DURING recent weeks the electrical world has been patiently awaiting the publication of the scheme which the Electricity Commissioners have had under consideration, and regarding which some broad hints have been thrown out on more than one festive occasion; but, as Col. W. Ashley emphatically stated at the I.E.E. dinner, the Ministry of Transport will not lay any scheme before the Cabinet until the situation has been thoroughly examined and the propositions have received the most ample consideration. The recent appointment of an Advisory Committee of three to assist the Commissioners in this respect may reasonably be taken to indicate that their scheme has at least been drafted, but presumably we must wait a few weeks longer before we may hope to be acquainted with the details.

In the meantime it will not be unprofitable to know the views of other engineers who have given close consideration to the problem of a nation-wide supply of electricity, and have endeavoured to solve it on independent lines. To one proposed solution—that of Mr. G. V. Twiss—devised and elaborated with great ability and thoroughness we have already drawn attention (ELECTRICAL REVIEW, February 20th, 1925, pp. 282 and 301), although, as stated on p. 362, we do not feel attracted by it. The scheme, involving the interposition of a third party between the producer and distributor of electrical energy, appears to be somewhat artificial, a "forced" fruit rather than a natural growth, and correspondingly costly; moreover, it appears to be based upon a false analogy—that of the transport of goods from the maker to the retailer, which is a fundamentally different proposition, for the common carrier, whether he operates by rail, road, or water, is at no time the owner of the goods that are entrusted to his care, nor is he in a position to control either the price or the destination of those goods. Further, it is doubtful whether the transmission of electricity over long distances would ever be economical in this country, wherein the conditions are wholly unlike those prevailing in the United States or Scandinavia, for example. Hence, as we have said, we have little liking for any scheme which rests upon the establishment of "national bus-bars." Adjoining undertakings can be coupled together through their networks, as is already done on a considerable scale in this country, and we take leave to discount the difficulties alleged to arise in respect of running in parallel systems thus connected. The mains should run not from station to station but from the stations to a common network.

Holding these views, we welcome the critical analysis of the situation which we have received from Mr. R. C. Andersen, and of which the first part appears elsewhere in this issue. The author first discusses the "national bus-bar" scheme, for which he has no sympathy, after which he examines the existing conditions of the electricity supply industry, and finally proceeds to enunciate the principles which in his opinion should be followed in order to ensure the efficient development of electricity supply on sound commercial lines. Like the Hon. Herbert Hoover, whose views were quoted on pp. 361-2 of our issue of March 6th, he adheres to the principle of private enterprise, regulated by the State, and foresees a bright future for the electricity supply industry.

National Electric Power.—I.

By R. C. ANDERSEN.

Once again following a sustained European war, Britain has been faced with a series of industrial crises consequent on a devastating trade depression. Once again the policy of the British Government has been, on the one hand, to safeguard this country from foreign entanglements, and on the other, to legislate for the relief of that restless section of its community which has been thrown out of work. As a means to this end, we have witnessed the introduction of a new element—the dole, while coincidently, large schemes for the absorption of the unemployed have been financed by the Treasury. Huge arterial roads begin to stretch like broad ribbons across the landscape. Slums are being cleared wholesale, and now there is the prospect of electricity becoming a pawn on the Government chess board. It is time for those engaged in electricity supply to bestir themselves.

Present Position of British Electricity Supply.

Available statistics, admirably framed in numerous papers presented at the first World Power Conference at Wembley last year, brutally revealed the backwardness of the industry when compared to the remarkable post-war advances that have been registered in other countries. Judged by European standards alone, British progress was in some instances so poor that it was represented by ratios of approximately 1 to 6 and 7. Naturally no reasons were given for this state of affairs. The comparative aspect was seldom or never touched on in individual contributions, so that it was only by setting papers alongside one another that the true circumstances were revealed.

The lesson of Wembley was illuminating so far as it went, but it did not disclose the weaknesses hindering the growth of the British system. Not so the findings contained in the fourth (and last) annual report issued by the Electricity Commissioners and published in the month of September. Here was a clear statement that British electric power supply was not expanding on the broadly economic, sound, and rational plane that it should do. Considerable opposition to its plans of co-ordination had been encountered by the Commission, and though not stated in so many words in the report, it was transparent that Government assistance in the shape of enhanced powers for the Electricity Commission might, and quite probably would, be evoked in order that proper progress could be effected. This was significant as indicating which way control of the industry was tending. Existing legislation had been responsible for the growth of vested interests which centred round uneconomic local points of supply, and little, it was inferred, could be accomplished until these centres ceased to afford a hindrance to productive development.

Proposal Involving "National Bus-Bars."

The Commissioners' report has given rise to much speculation as to their future powers and the consequences of these on the industry. Inevitably also it has offered an opportunity for the exploitation on paper of certain schmes for bringing British electricity supply up to the international standards of the Continent and America. Were this all, no word of warning would need to be uttered. But when—drawing its inspiration from the Commissioners' difficulties alluded to—one of these schemes advocates "national bus-bars" and thus leads direct to the nationalisation of electric power, it is incumbent on practical men to call a halt. We must carefully examine this much advertised proposal having regard to the known disastrous effects of this type of State control.

The substance of the plan under review resolves itself briefly into the following:—

(1) The only means whereby maximum efficiency in the British electric power industry can be obtained is by the creation of a single super-power-transmission system owned by a single and therefore a governmental body.

Anticipated cost of this work 6 million to 8 million pounds.

(2) This system, by connecting up the most efficient generating stations at the various load centres, will place itself in a position to undercut electricity supply from local generating stations.

Working cost per unit generated 0.3*d.* to 0.5*d.*, *working cost per unit transmitted* 0.1*d.*

(3) Immediately it becomes apparent that local prices cannot compete with those demanded by the national body, the Electricity Commissioners should by virtue of compulsory powers be in a position to shut down such local plant.

This in most instances would constitute financial hardship, to eliminate which compensation would be given to the small company from a fund specially created for the purpose.

Proposed fund two million pounds.

(4) The function of the single transmission line body would be to transmit energy only, and it would purchase its supply from privately owned generating stations and resell to authorised bodies—municipal or company—acting under special orders.

(5) For the scheme to be made practicable the frequency would have to be standardised throughout the country.

Estimated expenditure for this work 8 million pounds.

The project even in its bare outline is ingenious; but it must not be forgotten that a most vital community service is at stake. In the light of this circumstance the pertinent facts disclosed by a rapid analysis of the super-power scheme advocated are of interest.

Futility of Single Super-Power System for Britain.

(1) A study of the economic geography of Britain does not in my opinion indicate that a single super-power transmission network is the best or the *only* remedy for the relatively slow progress that has been made in the supply of electric power in this country.

The island is very definitely sub-divided into areas of intense production which appear as segregated localities on the map. Scotland, for instance, has two such areas, roughly 120 miles apart. The first area, stretching eastwards along the coast from Inverness to Macduff, is relatively unimportant. The second, running in a narrow band approximately 30 miles wide about the line Kilmarnock, Motherwell, Kirkcaldy, constitutes a parallelogram of coal, iron, and steel activities which is little short of marvellous.

The Inverness district has no coal, but enough water power for its needs. The Clyde is stiff with coalfields. Obviously, in the circumstances, a sound method of tackling this section of the country is to have two schemes of generation and supply—the one hydro-electric, the other based on steam.

Experience in other countries, particularly in the American state of Pennsylvania, leads one to the conclusion that the Clyde alone is so heavy a load centre that it would require two or perhaps even three power systems closely interconnected to deal adequately with its demand.

It is not advocated that the hydro-electric and steam systems should function separately for all time; quite the contrary. The two will naturally tend to interconnect as business expands. Inasmuch as expansion of business is the life blood of private enterprise, the power companies will strain rapidly towards one another, provided the field is capable of exploitation. If it is not, why then progress of contact will be slow.

In any case, however, useless expenditure of money will be avoided.

Surely development of the kind indicated is the proper way of safeguarding the country's available capital. Merely to erect a transmission backbone across Scotland in the hope that it may justify itself eventually is *not* sound finance.

Scotland lends itself readily to economic treatment. England and Wales are decidely more complicated owing to the overlapping of various industrial pursuits in given areas, but even here it is clearly seen that the economic layout of the territory runs somewhat as follows:—

Area No. 1.—South-eastern Northumberland and Durham.

Area No. 2.—The relatively small coal and iron district of Cumberland.

Area No. 3.—The relatively large cotton, coal, and iron areas of Lancashire and Yorkshire.

Area No. 4.—The pottery and coal districts of Staffordshire.

Area No. 5.—The engineering and coal districts having Birmingham as their centre of gravity.

Area No. 6.—Greater London (almost exclusively an urban load).

Area No. 7.—South Wales coalfields.

Area No. 8.—Cornish mines.

It is admitted that this grouping is very rough, and it is merely used here to give point to the statement that the economic lay-out of England and Wales is "spotty."

It may be claimed that the distance between these heavy-load centres is negligible from the point of view of overhead high-voltage transmission. This is admitted. Technically there is nothing to prevent a high-pressure transmission line running from John o' Groats to Land's End, but that is not the point. It is because the load centres are so concentrated in their character and because their load characteristics are such as to require special treatment that the one-system idea is economically unsound.

What is needed is not a single network functioning at an extra high voltage (say 150 kV), but a group of systems utilising the natural resources of the country close to hand, for economic generation and the eventual transmission of the energy so generated at a relatively low pressure (say 66 kV).

Britain is so fortunately supplied with coal, except in the east, south-east, and south (where incidentally the natural wealth of the country does not lie), as to permit of efficiency every whit as good as the generating of a unit for 0.3d. to 0.5d. to be obtained.

Coal-less districts afford a special study. North Wales has its water power, and so that territory can fall into line with those where coalfields are situated. There remain the south, south-east, and eastern districts, which with their rural, though not excessively sparse, populations can—as has been stated—form the subject of a special investigation.

2. Consideration of the ownership of the generating stations and transmission line network by private enterprise and the Government respectively, discloses a serious obstacle to the smooth working of the combination. There are a number of suppliers, but there is only one purchaser. This creates an impossible market, and it is difficult to see, even supposing that private enterprise is attracted by it, how a conflict over electricity charges can be avoided.

The number of suppliers occupied in this business obviously cannot be large. Rather than create deadly competition between themselves and thereby make their situation *vis-à-vis* their only customer more insecure than ever, they will certainly combine and demand a uniform price for their commodity. The price may or may not coincide with the views of the transmission line authority. In the latter event only two courses are open—namely, for the authority to accept the situation, or to enforce terms more advantageous to itself. The first alternative is unlikely, having regard to the Governmental constitution of the authority. The second means State possession, and it can be procured either by legislation or by a financial operation (with the taxpayers' money) having for its aim the purchase of the necessary proportion of shares of the companies concerned. Whichever method is chosen, the result is the same—direct nationalisation of electric power generation.

Note how the fire spreads. The type of market described is too artificial to exist. Concede State control of electric transmission and you have, to continue my metaphor, lit a flame that will consume all private enterprise having to do with generation. Why? Because generation and transmission of electric power are, from the point of view of business, a single and indivisible unit. As well insist that because they differ in motive medium, electric and steam traction should never function except under completely independent company organisations.

3. To legislate for a single carrier of electricity is to legislate for a strangle-hold monopoly with its attendant evils. Electric power is so fundamental a national commodity that the interests of the public can only be adequately safeguarded by keeping this service clear of any form of monopoly—Government or otherwise.

4. State operation, owing to the comprehensive fact that the money handled forms no portion of the private interests of those responsible for its expenditure, is notoriously inaffective. In these circumstances, why experiment with a system proven to be uneconomic when private enterprise in other spheres—notably in the industrial world—has demonstrated its ability to succeed?

5. Mention has been made of the artificial market which the proposal under review would tend to create in connection with the purchase of electric power by a single transmission line authority. This artificial effect would be reproduced at the distribution termini of the super-power network; but now it would be in a contrary sense, for there would be only one supplier faced by a multitude of purchasers open to be dictated to by the sole carrier of electricity.

The ultimate position, judged economically, becomes interesting. A triple organisation emerges—two private groups, each established at one end of a tenuous connecting link owned by a third party having nothing in common with the other two bodies. Quite apart from the fact that the ultimate charge for electricity would have to bear *at least* two profits, the divergent interests involved would tend to fight one another, with the result that the industry would find itself in a parlous condition militating against the effective and soundly economic progress we are all so anxious it should attain.

Enough has been said to indicate why it is my opinion that the best electrical service in this country cannot be obtained by creating a single transmission line network, and putting it into the hands of the Government. What, then, is the procedure to be adopted to gain the desired ends? This will form the subject of a separate article.

Water-cooled Furnace Walls.—In order to overcome the objections raised to the use of very large combustion chambers in water-tube boilers, *viz.*, (1) the loss of heat by radiation from the external walls of the combustion chambers, and (2) the cost of installing and maintaining the brickwork for the construction of these large chambers, the Underfeed Stoker Co., Ltd., has produced the "Murray Fin-Tube Wall." This new combustion chamber wall provides additional water heating or steam raising surface. Advantage is taken of the fact that the conductivity of steel is so greatly in excess of the rate at which heat can be absorbed, that a fin welded on to a water tube would transmit any heat which it absorbed with such rapidity to the water within the tube, that the fin could not reach a temperature at which it would become overheated or which would materially impair its power to absorb heat. The Fin-tube wall, therefore, consists of a fire brick wall lined internally with a number of 4-in. tubes with projecting fins arranged so that adjacent fins overlap. The tubes are arranged vertically and are connected to horizontal headers which are connected to the boiler in such a way that the circulation is as rapid and effective as that of any part of the boiler itself. Tests carried out on a boiler equipped with "Murray" walls are said to show total efficiencies of from 81.5 to 92.7 per cent.

Britain's Latest Broadcasting Station.

The British Broadcasting Co., Ltd., claims that its new transmitting station, on the roof of Messrs. Selfridge's stores in Oxford Street, has been successful since it commenced to function permanently. Undoubtedly reception has been much improved in certain districts; nevertheless, in others listeners declare that results are not so good. Radiation from the old Marconi House station was by no means symmetrical, and listeners have not yet had time to accustom themselves to the new conditions.

In conjunction with the details of the new 2LO 365-metre plant which were published in our March 13th issue, the accompanying illustrations are of interest. Fig. 1 is a view of the two lattice steel masts supporting the aerial with the "lead-in" on the right; they are each 125 ft. high.

The main transmitting apparatus, the official rating of which is 3 kW, is housed in one room; in fig. 2 can be seen, from right to left, the two Johnson and Phillips switch panels, next to which are two modulating panels, each with two valves. On the left is the oscillator panel.

On the right of fig. 3 is the independent drive panel, the function of which is to maintain a constant and pure-frequency carrier wave. The panels on the left accommodate the rectifier valves. This view also shows the racks for spare valves, which are of the Marconi-Osram type, each being about the size of a football and supported in a cage which can be withdrawn from the panel when adjustments need to be made after the manner of truck-type switchgear cubicles. Some of the apparatus which constitutes the high-frequency tuning circuits is visible in the illustrations.

Fig. 1.—The 2LO Steel Aerial Masts.

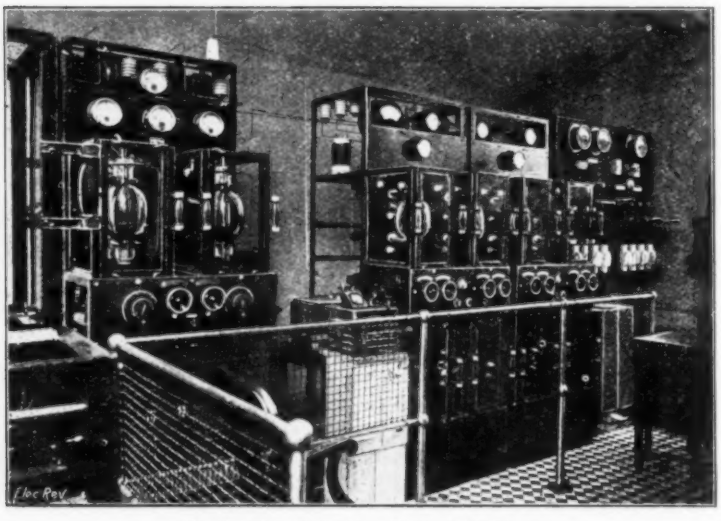


Fig. 2.—Part of the New Transmitting Plant.

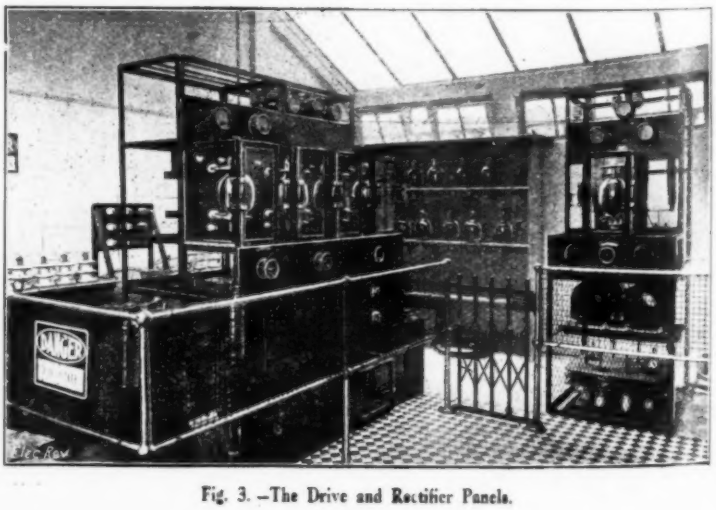


Fig. 3.—The Drive and Rectifier Panels.

It is understood that negotiations are in progress with a view to broadcasting the King's Speech at the re-opening of the British Empire Exhibition at Wembley on May 9th. The procedure will probably be similar to that followed last year when the speech was relayed to 2LO, whence it was simultaneously radiated from every station in the country. The arrangements for reproducing the speech in the exhibition grounds by means of loud-speakers are to be improved.

A curious position has arisen in the Irish Free State, where there are no broadcasting stations. In general, dealers import component parts, rather than complete sets, and assemble them for their customers, the only programmes they can rely on hearing being those transmitted by the B.B.C. stations. Listeners, however, contribute nothing to the service, the Free State Government retaining the whole of the annual fee of £1 which it charges for the privilege of installing a receiving set. Such a state of affairs should certainly not be encouraged, and it seems to be a case wherein the newly formed International Wireless Bureau could be of assistance.

Electricity supply interests in America are finding much food for reflection in the fact that, whilst broadcast reception as a household service has been available only for about two years, the average expenditure per family on the maintenance of receiving sets already amounts to nearly 30 dollars (£6) per annum, practically as much as the annual outlay on electric lighting. In short, American households to-day habitually spend as much on batteries and valve renewals as they do with central stations for energy.

D.C. Remote Control for Public Lamps.

The Use of Relay Switches.

By A. C. JOHNSON.

CONSIDERABLE strides have been made of late in the improvement of street lighting on scientific lines, and it is now possible to distribute artificial light so as to make streets as safe and as pleasant at night as in broad daylight without incurring an abnormal capital expenditure.

The most important limit to efficient street lighting is the cost of electricity and attendance, and any device which tends to reduce this cost deserves close attention. Most of the towns in this country still employ lamp lighters who start on their rounds one hour, or more, before official lighting time, and finish switching off one hour after switching off time; besides being costly in wages, this entails a considerable waste of electricity.

Time switches have been introduced as an attempt to overcome these disadvantages, but owing to the vagaries of clocks, allowance has to be made of, say, one quarter hour before and after lighting time. Wages of lamp lighters are eliminated, but against this must be set the comparatively large cost of the time switches, together with that of winding, adjustment, and repairs.

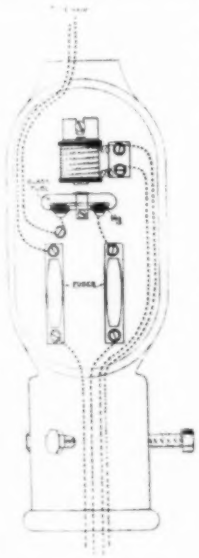


Fig. 1.—Relay Switch.

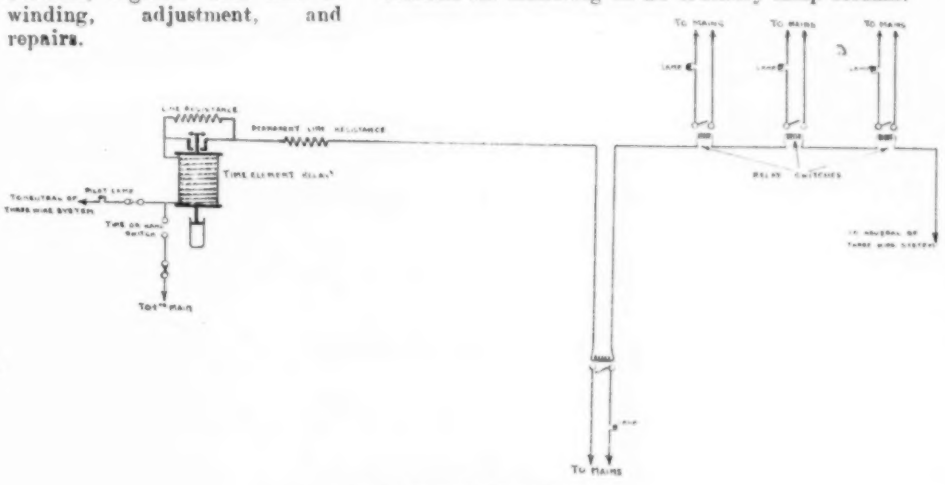


Fig. 2.—Street Lighting Diagram.

Some electric lighting undertakings have laid special mains for public lighting so as to be in a position to switch on and off at the generating station and thus save a considerable sum in energy and wages. Besides being very costly this system has the very serious disadvantage that the lamps remote from the feeding point are supplied at low pressure, whereas those close to the generating station have, probably, a very short life.

The remote-control system has the advantages of the last system without its disadvantages The apparatus is simple and requires practically no attendance, while the consumption of electricity by the street lamp is reduced to a minimum and the capital expenditure on wires is comparatively small. It consists of :—

1. A time switch and time element relay at the control station which may be situated at the generating station or any other convenient place.

2. Relay switches situated on, or near, the lamp columns.

3. A small pilot wire of .002 sq. in., or even less, connecting the control station to the relay switches.

The operating current returns to the control station through earth or through the network of mains, either a.c. or d.c. according to circumstances. Thus, on a d.c. three-wire system the pilot wire can be fed at the control station from the positive or negative side of the system, the current returning by way of the neutral mains. With the ordinary pressures of supply prevailing in this country a large number of relay switches may be connected in series on one pilot wire.

The relays may be constructed so that the operating current closes or opens the lamp switches. In the former case an open circuit on the pilot wire would plunge the streets in darkness with perhaps serious consequences, whereas in the latter case a similar fault would light the lamps during daylight hours, when they could easily be switched off until the fault was located and repaired. The second alternative has also the advantage of giving a quicker break on the switch than that obtainable with a weight or spring. A cheap and weatherproof relay switch suitable for small electric street lamps is illustrated in fig. 1. The lamp switch consists of a steel pin resting on two mercury contacts inside a horizontal glass tube. When the solenoid seen above the tube is energised the pin is attracted to the top of the tube and thereby opens the lamp circuit. The relay is shown fixed in a cast-iron box with a socketed end suitable for mounting on an ordinary lamp column.

It would require about ¼ watt to operate the relay, and only a fraction of this to hold the switch in position, so that the consumption per annum of each relay would amount to less than two kWh of electricity, at daylight rates, a negligible quantity. The current is cut down by means of a time element relay at the control station, which opens and inserts a line resistance of adequate size. Fig. 2 shows the general arrangement of the system, for which protection has been obtained.

A pilot lamp may be added to the switchboard equipment to indicate at a glance when the street lamps are alight, and also an ammeter to ensure that the current is kept as low as possible. The only important expenditure in connection with the remote-control system is the cost of the pilot wire, but as loans for cables are granted for a period of 25 years, the annual charges are small in comparison with the savings resulting from the adoption of the system.

The remote-control system could be adopted by undertakings supplying consumers on the two-rate system. Shop keepers would gladly pay a small rental for having their window lamps switched on and off by the supply undertaking. It occurs frequently that the pilot cable may be drawn through existing conduit, or that an existing pilot cable can be dispensed with as a pressure indicator and converted to the remote-control system.

The I.E.C. and International Standardisation.

The Basis of Fair Competition.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.I.C.E. M.I.E.E., F.R.Ae.S.

In the electrical industry, international standardisation has proceeded with less difficulty than in the older industries. The International Electrotechnical Commission, which is responsible for this work, was formed in 1906; that still youthful veteran, Col. R. E. Crompton, who crossed the sea to attend the recent conference, was one of its leading promoters. The Electrical Committee of the British Engineering Standards Association also acts as the British Committee of the International Commission. There are 27 countries taking part in this important work of electrical standardisation. It is important because it is setting up internationally a fair method of comparison of tenders for electrical machinery. Whilst the difficulties are, admittedly, very great, owing in a large measure to differences in local conditions which cannot easily be overcome or reconciled, yet steady progress is being made towards this desired object.

The International Electrotechnical Commission is a small League of Nations, and like its greater sister, it is proving itself of very great utility. As Germany has not yet entered the League of Nations, she had no delegates at the Electrotechnical Conference. On many sides regrets were expressed at their absence. This is really a matter of business and not merely one of sentiment, for after all, the underlying object of the I.E.C. is to ensure *fair* competition through the medium of international standardisation. Seeing that the date of Germany's joining the League of Nations is still somewhat uncertain, some modification is hoped for to enable her to be represented at the next conference.

The I.E.C. may be criticised in that in the past there was rather too much of the professorial element in its constitution. The objection is not to these very eminent gentlemen themselves, but rather that they were not in close enough touch with industry. Nowadays the manufacturers have realised the importance of international standardisation, and hence they spare no expense in putting forward their own views and experience. This involves considerable work and, further, is both of national and international advantage. A subtle change is taking place in the I.E.C. programme, for every year now its rulings are becoming more practical, economical and commercial—hence more effective.

Apparently the recent conference, which was attended by nearly seventy delegates, was one of the best that have been held, for one heard on all sides that the progress made in the discussions was very much greater than on previous occasions. A leparture from the usual practice was that a few papers by experts were read. This was the result of a suggestion by Signor Guido Semenza (the very active president of the conference), upon the success of which he is to be greatly congratulated. The idea was to concentrate proper attention upon the underlying principles and so to crystallise matters as to hasten decisions, by the elimination of extraneous material. At the same time, the policy was to avoid the reading of papers whose proper place was before some other conference or institution.

The success of national standardising bodies is largely due to the fact that so much care is taken not to put forward any specification which has not received the full backing of the industry prior to its issue. The attainment of this means almost endless conference and consultation, but it is the most satisfactory method in the long run. The step from national to international standardisation is a big one, for at once there has to be faced the difference in units, language, and racial characteristics. To facilitate this work there is in existence an unofficial Conference of Secretaries—a permanent body authorised by the Main Committees of the different national standardising bodies. It holds infrequent meetings, but the members are constantly in direct communication with each other through the secretary of the Swiss Committee, the central correspondent.

The 1925 I.E.C. Conference at the Hague was formally opened by Col. R. E. Crompton, who was described as its spiritual father. He was supported by the President (Signor Guido Semenza) and the honorary President (Professor Feldmann). The latter is also the host of the Conference, being the President of the Netherlands Committee. Professor Lorentz—of world-wide fame—and other notable men sat at the presidential table. At the conclusion of the opening session, the delegates were entertained to lunch by their Dutch hosts in the palatial building of the Literary Club.

The main subjects under consideration were: Nomenclature, Symbols, Traction Motors, Lamp Caps, Terminal Markings, Rating, Rules and Regulations, Standard Pressures, Prime Movers, and Transformer Oils.

Nomenclature.—It was decided to adopt the proof of the British standard glossary of terms used in electrical engineering as the basis of the principles for future work. This glossary is classified on a practical basis, *i.e.*, not on a theoretically logical form. That a practical classification was adopted as opposed to a mere alphabetical arrangement (with all the faults inherent to the latter) was mainly due to the suggestions first made some years ago by Prof. Absalon Larsen (Denmark) and Mr. G. J. Van de Well (Netherlands). On the proposal of the present writer, it was agreed to consider the numbering of the terms upon the basis of the International Decimal Classification system, and he was instructed to prepare a scheme for the purpose. The underlying idea of suggesting an international system of numbering as compared with an arbitrary one is (*a*) that it is truly international and independent of language; (*b*) that unlimited interpolation or elimination can be effected; (*c*) by aid of the universal numbers, words in the glossary of one nation can be used as a dictionary for the interpretation of words in another nation's glossary. As is usual with such a system, an alphabetical index will be included.

A special sub-committee was appointed to complete the nomenclature, consisting of the indefatigable chairman, Dr. C. O. Mailloux (U.S.A.), Mr. Janin (France), and Mr. C. C. Wharton (Great Britain). Their work will be facilitated by the fact that so many of the National Committees have almost completed their glossaries, hence the remaining work will largely consist of choice instead of creation.

Symbols.—A very comprehensive report covering the work on previous occasions was available. They should be very useful in the preparation of drawings, &c., as draughtsmen will have a definite standard to which to work. Most of these symbols are already in common use, but a number are at present indifferently used for different purposes, hence standardisation is essential. An important simplification is that in showing electrical wires which cross each other, instead of using brackets to indicate that crossing lines are not electrically connected, they are allowed to cross as straight lines; where the crossing lines are electrically connected, a dot is placed at the points of contact thus:—

The Hague Conference approved the work already done, after effecting a few slight modifications, hence if there are no serious objections from the National Committees, the volume will be available in about six months' time.

(To be continued.)

The British Electrical Development Association.

The Annual General Meeting.

THE fifth annual general meeting of this Association was held on Friday last at the Hotel Cecil, London, and a large company subsequently sat down to luncheon under the chairmanship of Sir George Sutton, Bart., the new president.

Mr. FRANK GILL, O.B.E., in proposing the toast, "The British Electrical Development Association," said that this country went ahead in the past because of its individualistic qualities, but we had reached the point where we could all pull together, and through E.D.A. they had co-operation. Though they might benefit their competitor they would benefit themselves by pushing forward the interests of the industry as a whole. They were selling a "tool" for industry; electricity was not a luxury. Was the nation so well equipped that it could afford to neglect or diminish the use of that tool? Could we afford to see other nations going ahead more rapidly than ourselves? To those who said that electricity was so useful and so important that it would sell itself he replied that electricity was a really good thing but they needed a consuming enthusiasm on the part of those who were dealing with it, and an intensive education of the public regarding its value. They could not run a "Service" idea unless they had a great enthusiasm for and belief in it. As they lowered the price of electricity the number of consumers would increase. In E.D.A. they had the manufacturers and the supply authorities, but they ought to make room for the consumer too. Was everybody—meter-readers, contractors and contractors' men, commercial and technical staffs, management and directors—filled with burning enthusiasm for electrical progress? If such were the case would not something big happen? Could not something be done to light the electrical torch so as to set fire to the place? There was said to be a tremendous load waiting for those who went after it. He suggested the slogan: "Why should the Load Wait?" If they had the push and advertising activity of the pill and toffee makers they would get on faster. They would thus make more work for the country which would quickly be productive and help us to take our proper place in the commercial struggle.

Sir GEORGE SUTTON, in responding, said that it was only within quite recent years that the need for advertisement by public utilities had been recognised in this country. The Act of 1919 made it possible for money to be spent by municipalities for educational work of that kind, but of course it could only be done through non-profit earning associations such as the B.E.D.A., which was formed to bring contractors and manufacturers and supply authorities together for the purpose of educating the public regarding what electricity could do. If they could get the public to understand the convenience, reliability, and economy of electricity there was no reason why the use of it should not be universal. That was E.D.A.'s work. Sir George quoted the successful propaganda work of the gas industry. We had something which could be of greater service to the community but we had to convince the public of that fact—at present it was only partly convinced. It must be wholly convinced and by the B.E.D.A. The Association had achieved great success in the four or five years of its existence, but they needed greater co-operation. A 10 per cent. growth of the membership in the fifth year was not enough. Every municipality and company should support the movement. They would cover their expenditure over and over again by the increased demand on their stations. The £33,000 spent on the Association demonstration at Wembley was not a large sum, but it was through co-operation that they were able to spend that amount. He heard of large firms which individually spent £50,000 and £60,000; those were large sums compared to the total outlay of this Association, but they were large concerns and older than this organisation. The Association could not afford to sit still. In the commercial world sales organisation and advertising were the departments which required the best brains obtainable. It was not good enough to leave the promotion of sales to somebody who would attend to it in the time that remained over after the performance of his other duties. Municipalities were trading concerns but very few of them indeed concentrated upon sales. E.D.A. could fulfil that purpose for them and concentrate on sales for electricity authorities who did not do it for themselves. Smaller authorities were content to let well alone unless they had an engineer behind them who could push them along. As trading concerns, however, they must adopt commercial methods. We produced engineers and men of business second to none in the world, but in his wide experience he found that very seldom, if ever, were the two qualities united in one person. Each should concentrate on his own particular job. The large manufacturing concerns of the country concentrated certain men upon sales and others upon engineering and allied problems. They never thought of giving their engineer the duty of promoting their sales. If he was right in his view on this point, he would say to the electricity authorities, and especially to the smaller ones, that they must join the B.E.D.A., which could fill that place in their concerns for them. They desired to make the Association a huge concern for the good of all, including the consumer.

Mr. A. F. BERRY, also responding, differed from Mr. Gill, in that he held that electricity *was* a luxury and a convenience, as well as a tool of universal applicability. There was something like 500 millions sterling invested in the industry; that sum would soon be doubled and trebled, and they must make sure that there would be an adequate yield on the capital, an object which could only be attained by publicity. The outlay at Wembley was only a beginning; they were now raising funds to educate the public in modern electrical methods. During the past five years they had been converting the members of the industry; the next step was to get those members to convert the public, with the aid of the Press. He was sure the industry would provide the money.

Mr. S. T. ALLEN, proposing "Our Guests," specially thanked those who last year had assisted the Association and its work, and remarked that few such Associations had been so cordially supported. The Association recognised the public demand for information on electrical matters, and was about to increase its activities to cope with it. Interest in electric lighting was reviving, as it was appreciated that it was useful for advertising, and for the maintenance of health, and was something more than a mere antidote to darkness, and much educational research was going on.

Responding, Mr. S. E. DOANE, of the International General Electric Co., who had come from the Hague to attend the luncheon, said that electrical development would profoundly influence civilisation, and the most electrical nation would prove to be the most efficient. Electrical people had only lately realised that "lighting" and "electric lighting" were two distinct things; by the proper lighting of factories, shops, &c., they could increase the efficiency of human effort. In the United States they had succeeded in inducing the people to support an educational campaign in which last year 40,000 persons were engaged, and he was sure that the same kind of development work would be successful in other lands. They were on the brink of a world-wide programme that would have extraordinary consequences.

At the annual meeting the report and accounts were adopted and officers and members of Council were elected.

The report showed that the membership included at December 31st, 1924, 101 municipal supply undertakings, 13 London companies, 11 power companies, and 62 provincial companies; manufacturers numbered 243, contractors 830, and wholesalers 66—total 1,326. The supply membership represented 75 per cent. of the total output of the country. The subscription revenue was derived 55 per cent. from supply undertakings, 40.5 per cent. from manufacturers, and 4.5 per cent. from contractors and wholesalers, the total being £10,654.

During the year, in addition to the work of the Council and Executive Committee, sub-committees were engaged upon the study of domestic electrification, standardisation, reform in tariffs, local exhibitions, agriculture, wiring rules, &c. Press advertising was carried on, especially in connection with the British Empire Exhibition and late shop lighting, and material had been provided to assist members in local advertising. During the year a great amount of publicity was obtained for the electrical industry through the editorial columns of the Press. Over three million items of publicity matter were purchased from the Association, besides which very large quantities of such matter were distributed by the Association at the British Empire Exhibition. Several kinema films were added to the stock, bringing the total up to ten films, which were in constant demand. Lectures were also delivered by the staff and by helpers, and the lantern slides and lecture notes were in continuous demand. Short talks on electrical subjects were given to students of both sexes in schools. Salesmanship conferences were held, for the fourth season, leading to increased enthusiasm and a demand for reprints of papers. Assistance was given to the Women's Electrical Association and other bodies, and arrangements were made for a very effective display of "Modern Lighting Service" by the E.L.M.A. Joint Lighting Service Bureau at the I.M.E.A. Convention. During the International Advertising Convention papers were read in the Public Utility Section by members of the Association, and in connection with the Coal Smoke Abatement Society's Exhibition an "All-Electric House" exhibit was organised, which was visited by 41,000 persons. A voluminous correspondence was carried on and numerous reports on matters relating to the commercial development of electricity supply were circulated to all the electrical undertakings in the country; many provincial engineers called at headquarters, and the director and business manager visited several provincial centres and addressed meetings.

In connection with the "Electricity in Service" exhibit at the British Empire Exhibition, support was received from 152 municipal undertakings, 89 companies, 19 power companies, and others, the funds collected amounting to £24,440; assistance was received from the B.E.A.M.A., the E.L.M.A., the C.M.A., and the E.C.A. by way of loans of material, and labour, having a cash value of probably £2,000, and an expenditure of £5,039 on advertising was incurred, the total outlay on the Wembley effort amounting to £33,373. It was estimated that one million persons passed through the exhibit, 400,000 conversed with the staff, and 10,000 inquiries were dealt with.

The National Physical Laboratory.

Annual Report: Continued Progress.

The annual report of the National Physical Laboratory for the year 1924 has been published much earlier than usual this season.* It records continued progress, the demands made by Government departments having increased as has also the number of investigations undertaken for private firms. The total number of tests carried out during the year (683,580) decreased by 12,633, as compared with 1923, but in the electricity department, including photometry, the total (2,981) shows an increase of 1,006.

The Executive Committee feels that it is very desirable there should be as little interference as possible with the fundamental research and standardisation work of the laboratory, notwithstanding the pressure of external requirements, and has found it necessary to ask for an increase in the "establishment" and again to press the need of additional accommodation; it is hoped that a commencement will be made during 1925 with the erection of a portion of the proposed new physics building.

General Research.—Attention has been given in the Physics Department to the devising of methods of determining certain physical constants of metals and alloys at high temperatures. In the Radiology Division investigations are proceeding into X-ray absorption and spectrometry, and "atomic physics." In the Electricity Department research on resistance materials is proceeding, and progress has been made with experiments on the earthing of electrical circuits; tests have been made to determine the electrical resistivity of different soils, and the effect of variation of temperature, moisture content and other factors, from which theoretical values have been derived for earthing electrodes of the forms employed in practice. Comparison will be made of these values with those obtained from actual measurement.

Considerable advance has been made with the research on heterochromatic photometry, which is being carried out to establish a satisfactory basis for photometric measurements of sources of light differing in temperature and efficiency. The work is at present directed towards the development of a furnace capable of operation as a primary source of radiation of known energy distribution up to the highest temperatures available; the upper limit is for the time taken as 2,300 deg. K. Methods of photometry depending on the use of a photo-electric cell are also being investigated, and the N.P.L. is indebted to the research laboratory of the General Electric Co. for assistance in the production of suitable photo-electric cells for this work.

Maintenance of Standards.—The Committee directs special attention to this section of the work, and has obtained the approval of the Department of Scientific and Industrial Research to a substantial increase in the provision made for work under this heading. The use of a wave-length of light as a unit of length is being investigated at the request of the Board of Trade, and the subject of an international temperature scale has been taken up formally by the Director of the Bureau International. Much attention has also been given to the ultimate establishment of the platinum thermometer as the standard temperature-measuring instrument over the range 0 deg. to 100 deg. C.

Work on the electrical units, as a result of the pressure of other work, has not been so rapid as is desirable. The reconstruction of the cylinders of the ampere balance is proceeding, and work on the standard tubes for the realisation of the international ohm has been continued; it now awaits only the results of the measurements of the lengths of the tubes. The values obtained for the other constants make it almost certain that the tubes have changed appreciably in the last ten years.

Comparative measurements of radio frequency have been made in co-operation with the Bureau of Standards and the Reichsanstalt, by means of simultaneous observations on the frequency of signals transmitted from a number of the principal wireless stations in Europe and the United States; further observations have been planned for the coming year. The large amount of other work falling under this heading which has been carried out in the Electricity Department included the investigation of a method of accurate calibration of large mutual inductances at telephonic frequencies.

Government Research.—The demands made on the laboratory by the Department of Scientific and Industrial Research continue to increase and experiments on the fatigue of metals have reached a very interesting stage, both deriving inspiration from and throwing light on modern theories of crystal structure. The research on the mechanical properties of materials at high temperatures is also yielding results of much interest.

Work for the Radio Research Board has been continued and the transmission of standard wave-lengths arranged by the Committee has been found very useful by the Services, and is being extended to wave-lengths below 900 metres; research on short-wave transmission and reception is proceeding. Work for the Air Ministry, under the general control of the Aeronautical Research Committee, has continued on the same scale as in previous years. Investigations for the Admiralty have appreciably increased in volume since the early part of the year.

Other Work.—The work done by the laboratory, on payment, for outside bodies has been maintained at a high level during the past year. Some increase has taken place in the number of routine tests, and the receipts from special investigations for firms were greater than in the previous year.

Test work in the Radiology Division has included leakage tests of radium tubes and applicators, tests of feebly radioactive substances and of X-ray protective materials. Attention is called to the variation in the lead equivalent of protective materials with the wave-length of the radiation, due to the fact that lead has an absorption band for radiation emitted at about 90 kilovolts. The inspection of X-ray departments in hospitals and of X-ray apparatus for hospital use has continued; there has been a marked improvement in the construction of such apparatus and in the protection afforded, and recommendations on somewhat similar lines to those of the British Protection Committee have been, or are being, drawn up by America, France, Germany, Norway, Denmark, Holland, Finland, and Sweden. Radiographic examination of heavily insulated cables has been made for the Electricity Department to reveal defects due to prolonged heating. Radiographs of cylindrical steel rods have been obtained by enclosing them in rectangular brass envelopes to reduce the scattered radiation.

In the Electricity Department work has been done towards the correlation of theoretical and experimental values of effective resistance at radio frequencies, and on the measurement of radio-frequency current. In conjunction with the Engineering Department an investigation has been commenced with a view to developing a method of locating faulty welded joints in plates. Experiments with material of high magnetic permeability have been made in addition to the standardisation of instruments. In the d.c. section, work on cables and further experiments on fuses are contemplated.

The work of the Photometry Division has included considerable investigation for the Illumination Research Committee, and has co-operated in the work on radio-active luminous compounds for the Chemistry Co-ordinating Research Board.

In the Metallurgy Department very satisfactory progress has been made. The work in hand for the British Non-Ferrous Metals Research Association includes the investigation into the effect of impurities in copper, the methods of determining oxygen in aluminium, the study of special brasses and high-tensile copper alloys, and the die-casting of aluminium alloys.

In the Aerodynamics Department the electrical apparatus described last year for determining experimentally the stream lines round any obstacle is being employed to investigate certain problems of two-dimensional motion. Hot-wire wind velocity and direction meters have been constructed.

The detail reports of the superintendents of the various departments of the laboratory are of great interest; for instance:

Physics Dept.—The investigation on the thermal resistivity of dielectrics undertaken for the B.E.A.I. Research Association has been completed. The object has been to provide information for the designers of electrical machines. The subject is of great importance, since the efficiency of a machine and its ability to withstand overload depend to a large extent on the rapid dissipation of the heat which is unavoidably generated in the several parts. The main problems already investigated include the thermal resistivity of dielectric materials (35 in number); the effects of contact resistance, due to air films, at the boundaries of a dielectric; the effects of air films on the resistivity of a number of superimposed layers of thin dielectric materials under various pressures; the compressibility of some of the materials; the change of resistivity with temperature; the variation in resistivity from point to point in sheets of composite material, such as micanite. During the past year attention has been directed to a study of the thermal resistivity of some specimen materials after they had been applied by the usual manufacturing processes to conductors as nearly as possible resembling those employed in practice, and a summary of the results is now in course of preparation.

The work on the thermal and electrical conductivity of pure metals was completed during the year. The investigation has dealt with the following metals in the solid state to a maximum temperature of 700 deg. C., *viz.*, aluminium, copper, magnesium, nickel and zinc. A paper on the subject will appear shortly.

The relation of the thermal and electrical conductivity of alloys is being investigated for the Physics Co-ordinating Research Board; the conductivities of seven specimens of copper alloys were determined for the Aeronautical Research Committee, and the results showed that over the range investigated (75 to 250 deg. C.) the Lorenz relation for pure metals held closely for the alloys. Apart from its theoretical interest, that means the thermal conductivity of the alloy at any temperature can be deduced from a comparatively simple measurement of electrical conductivity instead of by the somewhat difficult process of direct measurement. The extension of the research is under consideration and work has been approved on the conductivity at high temperatures of searchlight carbon materials.

* H.M. Stationery Office. Price 8s. 6d. net.

With a view to the design of an X-ray tube capable of passing extra heavy currents and of withstanding increased potentials, preliminary experiments with large cathodes of various curvatures have been carried out. In this connection a modified form of Pirani gauge proved to be of service, once means had been found of so screening the filament that measurements of pressure might be made during the passage of an electric discharge in the vessel to which the gauge was connected without any disturbance of the bridge resulting. It was then possible to follow the quick changes of pressure attending the passage of a heavy electric discharge. Some anomalous effects, observed while experimenting with such screened gauges and believed to be of electro-static origin, call for further investigation.

Electricity Department.—The work of the section steadily increases in all directions. In particular the test-work on inductances and condensers has occupied much time. One of the serious difficulties in connection with testing and investigation at telephonic frequencies is interference between the various sources and bridges and the necessity for quietness in the room in which the observations are made. The section is at present at the limit, regarding equipment and space, at which the work in hand can be carried out. If the present increase continues it will be necessary to consider further accommodation.

The Schuster magnetometer for the magnetic observatory at Abinger is complete. Measurements of the windings and the comparison of the instrument are proceeding. In connection with Dr. Chree's work on terrestrial magnetism at Kew Observatory, starting in the early summer of this year, a series of observations of H, the horizontal component of the earth's magnetic force, has been made by means of the Schuster magnetometer at the laboratory. The application of the horizontal magnetometer coil system to the measurement of the vertical component of the earth's field is receiving attention. The use of a small magnetized needle as an indicator is excluded in measurements of the vertical component. Using a small rotating coil of the maximum size permissible, it should be just possible to make measurements of V to an accuracy of one part in ten thousand when using a very delicate vibration galvanometer. Preliminary experiments show that at a frequency of 25 ~ per second, it is possible to construct a vibration galvanometer with a sensitivity of 1 mm. for 1×10^{-9} amp. With a coil wound to suit the galvanometer it should be possible to dispense with the need of an amplifier. To meet the increasing demand for measurements of small capacities a special bridge method has been devised. The readings which must be taken in order to eliminate the effect of capacities to leads are indicated and it is shown by measurements made on the standard case of two spheres in air that capacities as small as 0.1$\mu\mu$F may be satisfactorily measured by this method.

Work on materials for compass correctors is being carried out for the Physics Co-ordinating Research Board. A large wooden framework has been constructed, which has been wound with coils on the Helmholtz principle to provide either complete or partial compensation for the earth's field with maximum uniformity of field over a volume comparable with the dimensions of a binnacle.

Tests have been carried out on the new nickel-iron alloy, known as Permalloy, which has recently been produced in America by the Western Electric Co. The tests were carried out on the standard ballistic testing set, the specimen being placed within a system of Helmholtz coils arranged to neutralise the earth's field. The permeability curve was taken up to H = 25, at which value the flux density B was just over 11,000 and the material practically saturated. The maximum permeability measured was just 50,000 at H = 0.08— a field less than half the horizontal component of the earth's field—while the permeability at the lowest point measured, H = 0.02, was still 7,500. A series of hysteresis loops was also taken for values of $B_{max.}$ from 2,000 to 11,000, and the loss per cycle was determined from the area of the loop in each. Plotting the loss against $B_{max.}$ logarithmically, the points from $B_{max.}$ = 3,000 to $B_{max.}$ = 10,000 were found to be very exactly on a straight line, indicating a constant hysteresis index of 1.56. Over this range it appears that the loss can be expressed by the equation :—Hysteresis loss in ergs per c.c. per cycle = $0.00014\ B^{1.56}$.

(To be continued.)

Exports and Imports of Electrical Goods and Machinery in March, 1925.

The Board of Trade returns of last month's electrical trade showed that this was of a normal character. The exports were less than in February, although that was a short month; the decline of £48,000 was, however, not very serious, and in comparison with the total for March last year the increase of £320,000 was satisfactory. The three-months' total at the bottom of our table reveals an increase of close upon a million pounds as compared with the first quarter of 1924. The principal decrease during March was in "Submarine telegraph and telephone cable"—a constantly varying factor. Among the other decreases may be mentioned "Railway and tramway motors," "Other motors and generators," and "Telegraph and telephone wires and cable (not submarine)." Three of the four increases were important ones, the most notable being the rise of £31,000 in the item "Batteries and accumulators." Comparing the figures with those of the previous March, it is seen that the large increase was distributed very generally, and the only noteworthy decreases were in the items "Railway and tramway motors" and "Other motors and generators."

There was a general increase in the import list, the largest movement being a rise of £56,000 in "Electrical machinery (unenumerated)." This was off-set to some extent by the large fall in the cases of "Batteries and accumulators" and "Telegraph and telephone instruments." All the figures, with the sole exception of "Carbons," were higher than those of March, 1924. The total for the first three months of the current year was well above that for the equivalent period of last year.

The re-export total declined by about a third from the February figure. There were very large decreases in "Glow lamps," "Telegraph and telephone wires and cable (not submarine)," and "Telegraph and telephone instruments and apparatus." The only notable increase occurred in the item "Electrical machinery (unenumerated)." Both the three-months' total and the month's figure show advances on the 1924 re-export figures.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Mar., 1925	Inc. or dec. as compared with Feb., 1925.	Inc. or dec. as compared with Mar., 1924.	Electrical imports for Mar., 1925.	Inc. or dec. as compared with Feb., 1925.	Inc. or dec. as compared with Mar., 1924.	Electrical re-exports for Mar., 1925.	Inc. or dec. as compared with Feb., 1925.	Inc. or dec. as compared with Mar., 1924.
Electrical goods and apparatus (unenumerated)	£156,854	− £7,517	+ £18,992	£95,588	+ £6,317	+ £22,093	£5,685	− £808	+ £1,931
Insulated wires and cables ...	240,109	− 13,778	+ 39,995	49,622	+ 8,064	+ 21,023	1,323	− 228	+ 1,267
Glow lamps	43,311	− 6,107	+ 24,213	28,844	+ 2,671	+ 19,984	366	− 3,959	− 280
Arc lamps and parts	533	− 1,739	− 1,271	846	− 331	+ 58	1	− 1	− 8
Batteries and accumulators ...	91,921	+ 31,030	+ 35,874	27,177	− 23,399	+ 8,845	748	− 916	+ 716
Meters and instruments ...	32,078	− 1,492	+ 485	27,412	+ 1,866	+ 13,681	908	+ 154	+ 55
Carbons	4,656	+ 4,127	+ 1,403	8,264	+ 3,426	− 1,410	263	+ 181	+ 128
Electrical Machinery—									
Electrical machinery (unenumerated)	276,830	+ 54,724	+ 141,668	128,009	+ 56,226	+ 28,985	5,142	+ 1,883	+ 1,594
Railway and tramway motors	52,637	− 14,428	− 10,051	—	—	—	—	—	—
Other motors and generators ...	155,436	− 39,921	− 36,128	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	5,478	− 318	− 3,211	63	− 157	+ 19	—	− 164	− 76
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	67,812	− 13,940	+ 18,885	18,376	+ 3,052	+ 6,890	97	− 4,457	+ 97
Submarine telegraph and telephone cable	10,766	− 40,420	− 5,679	24	+ 24	+ 24			—
Telegraph and telephone instruments and apparatus ...	260,774	+ 1,361	+ 95,479	76,529	− 12,470	+ 21,857	5,542	− 2,043	+ 3,742
Totals	£1,399,195	− £48,418	+ £320,654	£460,754	+ £45,343	+ £142,049	£20,075	− £10,358	+ £9,166
Increases for the three months ended March, 1925		Exports. + £986,976			Imports. + £469,668			Re-exports. + £21,409	

Developments in Durban.

(From Our Durban Correspondent.)

An agreement has been arranged, after prolonged negotiations, between the Durban Town Council and the Electricity Supply Commission of South Africa by which the future generation of electricity in the Durban area will be under the control of the Commission. For many years the question of a new power station has been under consideration, but owing to the war, coupled with the difficulty of obtaining practically the only suitable site, which was held by the Government, no decision was arrived at, and the introduction of the Electricity Act of 1922 further deferred a settlement.

For the past fifteen years the S.A. Government Railways and Harbours Administration has taken current in bulk from the municipality at a basic price of 0.75d. per kWh for a minimum consumption of four million kWh per annum. The service has been a most reliable one, but the Administration was not disposed to renew the agreement in view of the possibility of the Electricity Commission's putting down a large generating station in the Durban area with the intention of offering a supply to the Administration for its present needs and with a view ultimately to a further demand when the railways become electrified in the Durban area. The Administration is already taking a supply from the large station at Colenso for the section of railways between Glencoe and Pietermaritzburg, which is partly electrified, and it is the intention to link up the Colenso and Durban stations when the latter is completed and the electrification of railways is extended to Durban.

The principal terms of the agreement between the Durban municipality and the Commission are briefly as follows:—The Commission shall at once take steps to obtain the necessary authority in the shape of a licence from the Electricity Control Board. The Commission shall then, with all reasonable dispatch, proceed to erect and equip a new generating station with an initial installation of two 12,000-kW turbo-alternators and necessary auxiliary machinery in accordance with plans and specifications to be prepared by Messrs. Merz & McLellan, consulting engineers to the Commission. The Commission undertakes to have the new station ready for giving supply by October 31st, 1927. The Commission shall take over the supply of current to the Railway Administration which is now supplied in bulk by the Durban Municipality. The Municipality shall take a bulk supply of not less than 48 million kWh per annum up to a maximum demand of 9,000 kW at 6,600 V, three phase, 50 cycles. The charges shall not exceed a fixed charge at the rate of £33,000 per annum, plus 0.29d. per kWh, subject to variation with the cost of coal. The Commission and Municipal power stations will be interconnected. For the purpose of ensuring co-ordination in the interests of both parties, the Commission shall appoint the present borough electrical engineer (Mr. John Roberts) as manager; he will hold the appointment in addition to his present municipal appointment. The Commission shall not supply electricity to any consumer within the area now served by the Municipality, or any extension of such area as may from time to time be approved of by the Electricity Control Board. The agreement is to remain in force for a period of thirty years.

Application is now being made by the Municipality to the Electricity Control Board for an extension of its area to a radius of sixteen miles, which will include all the suburbs around Durban, many of which have been supplied for some time past.

The Municipality at the present time is putting down a 5,000-kW set, which in all probability will be the last addition to its station, but at the present rate of increase in the demand this will be well loaded up by the time the Commission's station is ready to give supply. The site of the new station is at Congella, near the large graving dock which is shortly to be opened, and will have the advantage of tidal water for condensing purposes. From there cables will be laid to link up with the municipal station situated at a distance of approximately three miles.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. *No letter can be published unless we have the writer's name and address in our possession.*

X-Ray Apparatus.

I have noticed in the Electrical Review a report of a speech made in Parliament by Dr. Little relative to the import of X-ray apparatus. In this speech Dr. Little has apparently made the statement that "the best modern apparatus is not made in this country."

I do not know if he is one of those unfortunate men who seem to think it their bounden duty to belittle British work and enterprise, but if he is really open-minded enough to inquire into the matter he will have to admit that there are no grounds for his statement.

Continental and American manufacturers have, of course, their specialities, and, equally, British firms have theirs. At the present time, for instance, we in this country are a long way in advance of the foreigner in the important matter of protection (X-ray and not political protection, I mean), and I simply cannot call to mind any developments of importance in which this country is behind.

It is true that the German State-aided hospitals are far more ready to purchase new and experimental plant, while the British radiologist is more cautious as to expenditure and also more careful of the health of his patient, and therefore not so keen on rushing at a new technique till its advantages are proved.

For example, we who are connected with the industry can remember when "One-Flash" X-ray apparatus was introduced on the Continent with a great flourish of trumpets. One British firm, determined not to be behind and yet conscious of the fact that sales on the Continent were no criterion of sales in this country, imported a complete outfit and placed it on sale in its showrooms with a view to taking up the manufacture if manufacturing were justified.

The medical profession was widely circularised, and many leading radiologists called to inspect the apparatus, but not one single sale resulted, and at the end of six months the plant was returned to the Continent and disposed of there; and yet in Germany exactly similar outfits were selling like the proverbial penny buns.

It had been overboomed, and "One-Flash" apparatus came and went, and is little heard of to-day; and I could, if I wished, point to even more recent illustrations of the same thing.

The point is that the British manufacturer cannot afford to take up "stunts," simply because the British hospitals will not install them; but apart from this essential difference in the national character or the national finances, British manufacturers of X-ray apparatus are certainly no whit behind and in many ways are in front of their Continental competitors.

R. S. Wright.

London, *April 15th*, 1925.

Conditions in South America.

"Hispano" gives too little information (at p. 573, April 10th) about himself. I have known real workers "find their feet" quite promptly, both in Brazil and in Argentina; but, having decided to go, "Hispano" will, in my opinion, be well advised if he exhausts the possibilities of securing an appointment from a British concern—the directories give the British office addresses of South American concerns—before he sets sail.

I have also known young men to try their luck and to exhaust considerable funds without having secured a post. There are sharks in every city ready to deplete the funds of the stranger and to bait him with empty promises. I have a son out there, but he secured his post in advance of sailing.

U. S.

April 14th, 1925.

The Dimensions of Commutators.

I am indebted both to Mr. Carter and Mr. Huggins for their additional remarks on the performance of commutators.

I should perhaps have made it clear that in the case of the overheating cited every obvious precaution had been taken to ensure mechanical perfection and to eliminate any possible electrical disturbance. For instance, although commutation was absolutely sparkless, the interpole strength was adjusted, as a further precaution, until zero potential across the brush was obtained.

Mr. Huggins's suggestion that the correct span of armature coils will bear on the results, forces an admission that I have assumed that the obtaining of a negligible commutating voltage would render correct spanning of small consequence. Not, of course, that one would voluntarily introduce an incorrect span, but in commercial practice many restrictions arise which are not met by the academician; the generator in question had 42 armature slots, which precludes the possibility of a mathematically correct span of coil. I must thank Mr. Huggins for this line of investigation to which I have previously given too little attention.

Too well can I uphold the contention that manufacturers' figures vary and that the quality of their products diminishes from one month to the next, but I am of the opinion that the trouble experienced with this particular machine was due to some latent cause such as that indicated by Mr. Percy Huggins; of the exact nature of the cause I am not yet convinced.

S. Henderson Haynes.

Manchester, *April 14th*, 1925.

The Shannon Electrification Scheme.

Your criticisms of this project are fully justified, but like all the other criticisms which the writer has seen miss the real point, well known to all who have lived in Ireland.

This is that the scheme in question, in its inception and execution, is not merely an economic proposal, but a political gesture intended to gratify the still lively desire to "spite England." To this it owes much more than half of its attractiveness in the eyes of its authors.

Irish traders are no doubt individually grateful to England

for taking 95 per cent. of their exports, but if you imagine that the political mind of the Free State regards this fact with anything but mortification, to say nothing of gratitude, your knowledge of the curious Irish mentality is gravely at fault.

Ulsterman.

April 18th, 1925.

[The possibility that such a motive is at the root of the matter has been present in our thoughts, but we have seen no evidence to support that view in the mass of material that has passed through our hands.—EDS. ELEC. REV.]

Cage Aerials.

May I reply to Mr. Killingworth Hedges and say that I have experimented with these aerials considerably, and have disconnected the cage from the down lead and got—nothing. If the down lead is long enough, a cage becomes superfluous. As Mr. Hedges mentions a crystal set, I presume he is in close proximity to a broadcasting station. I am referring to valve sets only.

C. Culmer Hodges, A.M.I.E.E., A.M.I.Mech.E.

Electricity Works, Dawlish.

April 18th, 1925.

Luminous Electric Radiators.

With reference to the article under the heading "Popular Electrical Enterprise," in your issue dated April 3rd, we are substantially in agreement with the views expressed, but would call your attention to a statement therein which we are afraid will be read to mean something in our opinion demonstrably wrong, and likely to be injurious to our business. The portion of the article to which we take exception is the following:—

> "Unsatisfied consumers are to be met . . . who fail to appreciate the excellent qualities of the many electric fires now available, because they are making use of primitive luminous radiators."

It should not require very much thought on the part of any unbiased critic to give the luminous electric radiator its due. The luminous electric radiator was, of course, introduced by our Mr. H. J. Dowsing in the early days of electric heating, and no doubt created a desire for electrical service generally. It is not an uneconomical appliance, and this will be realised more fully when we state, on the authority of Prof. Fleming (in a Cantor lecture) that "only 2 per cent. of the electrical energy in such a heater is turned into light," and light rays when absorbed are turned into heat (see "Heat, a Mode of Motion"—Tyndall).

We ourselves, in common with others, have for some years been manufacturing, in addition to luminous radiators, what is known as "Red-Hot Bar" fires, not because the latter are more economical, or give more heat for a given consumption of current than luminous radiators, but because of a demand for something considered more up-to-date and (erroneously) more efficient as a heating appliance, this idea being engendered by just such careless remarks as the one to which we now take exception.

Effective radiant heat, or radiant energy, is dependent upon the intensity of the luminous rays produced, and the filament of the luminous radiator is, of course, very much brighter than the source of heat in the red-hot bar fires. Because of the intense radiation given by luminous radiators they are truly economical, as they may be used satisfactorily and effectively even for only a few minutes if desired, to warm the person or persons without waiting for the air of the room to warm up.

Many people are again realising the superiority of the luminous radiators, which is evidenced by increased demand. Perhaps this is partly due to the increasing interest taken in the "Sunshine Cure." Luminous radiators produce a small but useful part of the visible spectrum containing many heat rays of a valuable curative nature.

The Dowsing Radiant Heat Co., Ltd.

(F. M. STEELE, *Engineering and Sales Dept.*)

London, *April 16th*, 1925.

[The "careless" comment objected to was made after full deliberation. Circumstances have brought under our personal observation recently a number of domestic installations which sadly need modernising. The comment in question was partly inspired by the remark of the editor of a non-technical London paper, who, after declaring to us that "electric fires were no good," revealed that those with which he had had experience were of the lamp type, that they had been in service for many years, and that he now used in other rooms gas fires which were superior to the electric. We did our best to convert him, but his unfortunate experience predisposed him to prejudice when the claims of present-day electric fires were mentioned. The relative merits of luminous and other types of electric fires may be a subject for very interesting discussion, and we welcome it in our pages. We have never hesitated to give the luminous radiator its due. Our article particularly referred to out-of-date installations, and *primitive* radiators. Things which obstruct the path of electrical progress should be consigned to the scrap-heap. The "luminous radiator" which we had in mind consists essentially of a number of carbon-filament lamps with elongated bulbs, housed in a fitting usually provided with metallic reflectors. As our correspondents themselves declare, on the authority of Prof. Fleming, "only 2 per cent. of the electrical energy in such a heater is turned into light." This quotation is fatal to the claim that the "luminous radiator" is efficient as a radiator of heat waves. What becomes of the 98 per cent. of the energy which is not radiated in the form of light? The answer is given in an article by Mr. H. J. Dowsing, a copy of which has been sent us by our correspondents: "Glass is practically opaque to dark heat rays." That, as the author points out, is the reason why a greenhouse is heated by sunlight; the light rays pass easily through the glass and are transformed into heat inside the greenhouse, and the heat cannot escape through the glass by radiation. In the same way, 98 per cent. of the electrical energy furnished to the "luminous radiator" is trapped by the glass bulbs; the glass grows hot, and the heat is removed mainly by convection currents of air. Hence the "luminous radiator" really distributes heat very largely by convection and not by radiation. Its chief merit lies in the cheerful glow which it emits.—EDS. ELEC. REV.]

Several letters have been received too late for insertion this week and are therefore held over.—EDS. ELEC. REV.

The Blondel Oscillograph.

THE accompanying illustrations relate to a bifilar oscillograph designed by M. A. Blondel; the instrument in question is a laboratory pattern, but he has developed also a portable type, suitable for industrial purposes.

Fig. 1 shows the complete apparatus with the covers removed. On the right, in front of the arc lamp, is a motor driving the photographic film; on the left is the electromagnet and moving system, with the collimator in front of it, and

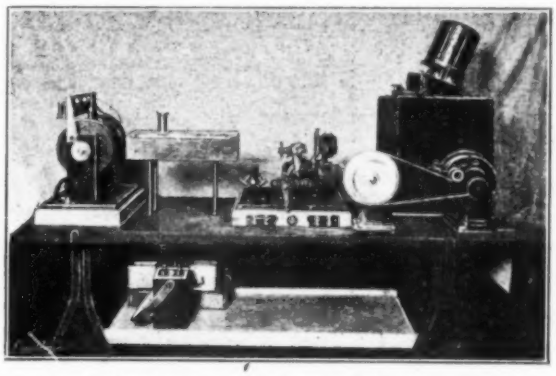


Fig. 1.—General View of Oscillograph, with Covers removed.

in the middle is a synchroscope which enables the waves to be thrown upon a ground-glass screen. An eye-piece on the collimator allows the mirrors to be seen.

Fig. 2 shows the arrangement of the optical system. From a source of light S a beam falls upon the mirror M of the oscillograph, traversing on the way a lens L_1, and a smaller lens O. The reflected rays are received by the lenses L_2 and L_3, of which the latter brings them to a focus on a sensitised film AB, which is moved at right angles to the rays in the direction of the arrow. The apparatus is provided with three mirrors, each of which projects a beam upon the film AB, the

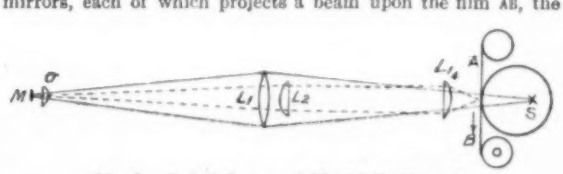


Fig. 2.—Optical System of Blondel Oscillograph.

foci lying side by side; in order that the three beams may not be superposed, a diaphragm is mounted in front of the luminous source S, with three vertical slits, each allowing a narrow bundle of rays to fall on the corresponding mirror. If it is desired to inspect the curves with the naked eye, before recording them on the film, the reflected rays leaving the lens L_2 can by a simple device be thrown on an oscillating mirror, which directs them upon a ground glass screen fixed on the top of the box containing the apparatus.

Details of the moving system are shown in figs. 3 and 4. Referring to the latter, a wire *ab* is held in the form of a loop between two ivory bridges P and Q with sharp edges,

in which are formed grooves to keep the wires at the right distance apart. The ends of the wires are clamped under two nuts N_1 and N_2, which form the terminals of the leads from

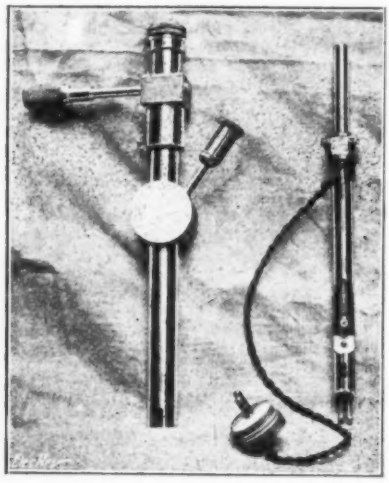


Fig. 3.—Moving System and Oil Box.

the circuit in which the current is to be studied. The loop is formed round an ivory pulley C carried by a device for regulating the tension of the wires. A small mirror M is cemented to the two wires in the axis of the strong magnetic field set up by the magnet, and is deflected when the wires are traversed by a current. The natural period of vibration of the system is controlled by the tension of the spring R, and damping is provided by immersing the moving system in a special oil.

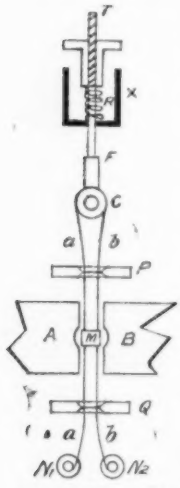


Fig. 4.—Diagram of Moving System.

The dimensions of all the parts are very small; the distance between the bridges P Q is 10 to 15 mm., and that between the two wires is only two or three tenths of a millimetre. The width of the air-gap is seven to eight tenths mm., and the little mirror is from 0.6 to 1 mm. square, the size depending on whether it is desired to obtain frequencies of the order of 8,000 to 10,000 cycles per second, or of 4,000 to 5,000 only. A plano-convex lens is placed in front of it, fixed to the box which contains the oil.

The optical system is complicated because it has to allow images to be obtained of sufficient intensity to be photographically recorded, in spite of the rapidity of movement of the "spots." At the usual frequency of 50 cycles per second, a single period should be recorded on a length of 6 cm.; the speed of unwinding of the film must therefore be 3 metres per second, and higher speeds are necessary for the registration of more rapid phenomena. The mirror has an area only about 1/100th of that of a galvanometer, and therefore a very intense source of light is required for photography.

American Turbo-Generators.

An interesting report has been prepared by the Turbine Sub-Committee of the Prime Movers Committee appointed by the National Electric Light Association.

The individual performance of 106 turbo-generator sets of from 18,000 kW to 60,000 kW capacity was studied, and for 87 of these full information as to operation in 1923 was obtained and has been analysed and aggregated by the sub-committee. The capacity of these sets was 2,506,000 kW, and the total possible operating time was 748,148 hours. The machines were required for a total of 78.4 per cent. of this time and were actually operated for 72.4 per cent. of the time. The machines were only unavailable for service for half of the balance of the time (27.6 per cent.). During 14.6 per cent. of the time they were ready for immediate starting had they been required. Thus the time lost due to other causes amounted to about 13 per cent. of the total possible time. An analysis of this figure distributes the responsibility as follows:—Steam turbines, 7.33 per cent.; generators, 1.74 per cent.; condensers, 3.18 per cent.; other causes, 0.66 per cent. The following table gives a detailed analysis of the four causes of idle periods mentioned in the last paragraph:—

Analysis of Lost Time in Turbine Installations.

Steam Turbines.

	Percentage.
Steam casing and joints	3.74
Governors	0.91
Control gear	1.58
Shaft rackings	2.84
Nozzles and diaphragms	4.87
Shaft and coupling	0.07
Wheels or spindle	14.64
Buckets or blades	14.69
Vibration	1.08
Bearings	2.73
Lubrication system	2.26
Cleaning oil system	4.92
General inspection and overhaul	43.75
Miscellaneous	1.93
Total for repair and maintenance	100.00

Generators.

	Percentage.
Vibration	16.80
Oil leakage	0.76
Armature core	4.08
Armature windings	14.54
Field windings	27.88
Exciter	12.09
Inspection and cleaning	20.7
Miscellaneous	3.16
Total for repair and maintenance	100.00

Condensers.

	Percentage.
Leakage	7.53
Cleaning	66.8
Tubes	14.52
Shell	0.76
Circulating pumps	6.32
Condensate pumps	1.09
Air pumps	1.39
Miscellaneous	1.59
Total for repair and maintenance	100.00

Other Causes.

	Percentage.
General piping	26.15
Boiler room	2.23
Plant, electrical	45.73
Other plant	0.59
Miscellaneous	25.3
Total for repair and maintenance	100.00

The conclusions at which the sub-committee arrives after consideration of the figures obtained are as follows:—

Turbines.—About 44 per cent. of the time, or 11 days a year per machine on the average, was required for the periodical, thorough overhaul to make reasonably certain the best of performance. Repairs to the turbine spindles, involving 29 per cent. of the repair period, were confined mainly to turbines produced several years ago. Due to the manufacturing refinements now employed, vibration and erratic behaviour of operating balance of the turbine have been eliminated from new machines, and the activities of the Sub-Committee on Lubrication have led to improvements in the bearings and lubrication systems.

Generators.—The generator performance of 1.7 per cent. for essential repair and maintenance time is a material improvement over previous records. The installations with closed air circulation are proving this practice very desirable. The air may be cooled effectively by spray systems or radiator coolers, the latter method being the one at present most used in new work.

Condensers.—As the operating time demand on units increases and other parts than the condenser improve, the repair and maintenance time necessarily allocated to the condenser increases, being now over 3 per cent. Condensers must give better performance than in the past if the use of higher steam pressures is to attain the desired results.

Construction.

American manufacturers of large turbine units are now prepared to take orders for units of any reasonable capacity for steam pressures up to 1,200 lb. and/or temperatures about 750 deg. F. Provision for the withdrawal of all the steam for re-heating and return to the turbine and/or extensive stage bleeding may be arranged. The effective removal of moisture in the lower stages of turbines by some mechanical means incident to stage bleeding would meet a real economic need but, as far as the committee knows, attempts so far have not produced the desired result. In the past 35,000 kW has been the largest rating of 1,800-r.p.m. single-generator units that have been built, but improvements in insulation and ventilation methods now make obtainable a 50,000-kW, 1,800-r.p.m. generating set using separate ventilation blowers and cooling the air after compression.

The possible desire to use eventually 1,000-lb. pressure compound units is causing present design arrangements for moderately high pressures to admit of such a change later.

Business Notes.

Bankruptcy Proceedings.—W. T. ROBINSON & H. ATTERBY (J. P. Beckett & Co.), electrical engineers, 134, Victoria Street, Grimsby, and W. T. ROBINSON (separate estate).—Last day for proofs for dividend, May 1st. Trustee, Mr. M. S. Forrester, 1, Town Hall Street, Great Grimsby.

G. W. RIDLEY, Rock Cottage, Whittle-le-Woods, trading at 1, Alfred's Court, Chorley, electrical engineer and contractor.—The public examination of this debtor took place at Preston Bankruptcy Court on April 17th. The deficiency was £263, and debtor, formerly a journeyman electrician, said that he commenced business on his own account with £30 savings in June, 1923. He did not think there had been any profit in the business. He attributed failure to want of capital, sickness in the family, and keen competition. The examined was adjourned.

H. A. BIRLESEN, electrical engineer, St. George's Street, Chorley.—This debtor underwent examination at Preston Bankruptcy Court on April 17th. It was stated that he traded as Birlesen & Co. at premises in Clarence Buildings, Chorley. There was a deficiency of £654, and failure was attributed to losses on contracts and illness. Debtor said he was formerly a journeyman electrician, and commenced business on his own account in 1919. He had no capital at the time. In January, 1923, he took a Mr. Lakin into partnership, and they traded as Birlesen & Lakin. Lakin left the business in January, 1924; there had been no profits. The examination was adjourned.

J. EAVES, electrical engineer, 102, North Road, Preston.—The public examination of this debtor was held at Preston Bankruptcy Court on April 17th. His statement of affairs showed assets estimated to produce £1, leaving a deficiency of £552. Debtor commenced business on his own account in January, 1922, having a few pounds saved as capital. He had no profit from the business, and could not say what his turnover was. The examination was adjourned.

M. C. JONES (M. C. Jones & Co.), stockists of wireless parts and accessories, 239, Westgate Road, and 65, Thornton Street, Newcastle-on-Tyne.—Supplemental dividend of 2d. in the £ payable May 1st at Messrs. Brittain & Brittain, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne.

A. MEADOWS, electrician, The Arcade, Penzance.—First and final dividend of 4s. 8d. in the £ payable at the Official Receiver's office, 12, Princes Street, Truro.

G. W. H. HANFORD (Radio Manufacturing Co. and O. I. C. Manufacturing Co.), 37, Gold Street, Southsea.—Last day for proofs for dividend, May 4th. Trustee, Mr. C. Hoult, Official Receiver, 87, High Street, Portsmouth.

Company Liquidations.—MOTOLITE DYNAMOS, LTD., Landor Road Works, Shepherd's Bush, W.12.—A meeting of creditors was held on April 15th, at the Cannon Street Hotel, E.C., when the chair was occupied by the Liquidator of the company, Mr. Lionel S. Challis. The chairman reported that he was a director of the company, and from the company's inception had been the sole source of capital, and from time to time had advanced cash. A statement of affairs was presented which showed liabilities of £7,483, of which £922 was due to the trade, there was a bank overdraft of £236, Mr. Challis was a loan creditor of £5,680, and there were employés' salaries in arrear amounting to £586. The assets were valued at £271, from which had to be deducted preferential creditors amounting to £225, leaving net assets of £46, or a deficiency of £7,483. The company was incorporated in 1922 with an issued capital of £2,250. The loss for the year ended March, 1924, was £2,700. Another director of the company said Mr. Challis was prepared to purchase the creditors' debts for the sum of 2s. 6d. in the £. The creditors thought that Mr. Challis should offer a more substantial composition, but it was eventually resolved to confirm the voluntary liquidation of the company with Mr. Challis as liquidator, on the undertaking that he would purchase the debts of the unsecured trade creditors at the rate of 5s. in the £.

The following are creditors:—

	£		£
Accumulators of Woking ...	38	Monarch Engineering Co., Ltd.	25
Baltic Scandinavian Review ...	35	*Motor Cycle and Trader* ...	29
Challis, C.	32	Russell, S., & Sons	45
Hardy, W.	47	Smith & Sons	28
Lindley, Jones & Co.	29	Skefco Ballbearing Co., Ltd. ...	41
Ilife & Sons, Ltd.	167	Skelton, W.	58

STANLEY ENGINEERING CO., LTD.—A meeting of creditors was held on April 17th, when a statement of affairs was presented showing liabilities of £1,048 and assets of £200, a deficiency of £848. The deficiency was attributed to continued trade depression and depreciation of stock. The matter was left in the hands of the liquidator, Mr. J. W. MacKinnon, C.A., 145, St. Vincent Street, Glasgow.

C. I. HUGHES & CO., LTD., electrical engineers, 12, South Road, Waterloo, Liverpool.—A meeting of creditors was held recently at Liverpool. Mr. P. S. Booth, the liquidator in the voluntary liquidation of the company, occupied the chair, and submitted a statement of affairs which disclosed liabilities of £491. The assets totalled £161, leaving a deficiency, as regarded the creditors, of £330. The issued capital of the company was £530, and as regarded the shareholders, there was a deficiency of £860. It was reported that the company was registered on April 28th, 1924, with a nominal capital of £750, and was formed to acquire the business of electrical engineers which had been carried on by Mr. C. I. Hughes. The company at the outset was successful, but finally contracts were withdrawn, and voluntary liquidation was decided upon. The creditors passed a resolution confirming the voluntary liquidation of the company, with Mr. Booth as liquidator.

The following are creditors:—

	£		£
Downes & Davies	136	General Electric Co., Ltd. ...	72
Electric Lamp Factors, Ltd ...	32	Western Electric Co., Ltd. ...	49

NAPIER-KIMBER, LTD., 6, Percy Street, London, W.1, and late St. George's Hall, Bradford.—In pursuance of an Order of the Court a further meeting of the creditors of the above was held on April 16th, at the Institute of Chartered Accountants, Moorgate Place, E.C. The creditors were originally called together on March 9th last, when the statement of affairs presented showed liabilities of £15,000, against assets of £11,841. The latter were subject to preferential claims of £429, and debenture claims of £8,532. The net assets therefore were £2,880, or a deficiency of £12,120. The issued capital of the company was £2,161, and as regarded the shareholders there was a deficiency of £14,281. At that meeting a resolution in favour of the voluntary liquidation of the company being continued, was defeated on a show of hands, and it was stated that a petition for the compulsory liquidation of the company had been presented.

Mr. H. Gillett, of Messrs. Dixon, Wilson, Tubbs & Co., C.A., 24, Basinghall Street, E.C., reported that the meeting that day was being held by an Order made by Mr. Justice Romer for the purpose of ascertaining whether the creditors desired the company to be wound up by the Court or for the voluntary liquidation to be continued, either with him as liquidator or some other person in his place. He was appointed as receiver for the debenture holders (the bank), and also as the liquidator in the voluntary liquidation of the company. As the receiver, he had realised certain of the assets and had been able to reduce the claim of the debenture holder by £4,000, and at the moment there was over £900 in hand. There was a quantity of stock remaining which might have to be offered for sale by tender. The total amount realised from the sale of the Bradford business was approximately £3,100.

On a poll being taken, it was announced that creditors for £7,134 were in favour of the voluntary liquidation of the company being continued with Mr. Gillett as liquidator. Creditors for £2,629 were in favour of a winding up by the Court.

The Chairman stated that the result of the voting would be reported to the Court in due course.

A committee was nominated, consisting of the representatives of Electric Lamp Factors, Foster Engineering Co., Ltd., and Callender's Cable & Construction Co., Ltd.

SUMMERS ELECTRIC & ENGINEERING CO., LTD.—A meeting of creditors is called for April 27th, at the offices of Messrs. Darke, Robson & Batty, 146, Bishopsgate, E.C. Liquidator, Mr. F. B. Darke.

WIRELESS MANUFACTURERS, LTD.—A meeting of members is called for May 18th, at 1 & 2, Great Winchester Street, E.C., to hear an account of the winding up from the Liquidator, Mr. F. Morse.

WIRELESS CONSTRUCTION CO., LTD.—A meeting of members is called for May 18th, at 1 & 2, Great Winchester Street, E.C., to hear an account of the winding up from the Liquidator, Mr. F. Morse.

Private Arrangements.—W. R. GRIGSBY, trading as the Wenham Lighting Corporation, manufacturers and factors of lighting accessories, 184, Gray's Inn Road, W.C.1. A meeting of the creditors of the above was held on April 17th, when Mr. W. Baker, of Messrs. Poppleton, Appleby & Hawkins, was elected to the chair. A statement of affairs was submitted which disclosed liabilities of £2,589, made up as follows: trade creditors, £1,333, cash creditors, £748, and bank overdraft, £508. The assets totalled £850, from which had to be deducted £43 for preferential claims, leaving net assets of £807, or a deficiency of £1,783. The business was commenced by the debtor's father about 30 years ago. It was then merely a gas lamp manufacturing business. In 1912, the debtor took over the business and settled with the existing creditors. He also extended the business by adding electrical work, and it paid its way up to the time he joined the army in 1916. He was away for three years, and during his absence the expenses were cut down and the takings covered the expenses. On his demobilisation, the debtor added a factoring business in electrical goods, and owing to the increase in the business he had to borrow from friends. He made a large purchase of lamps, and while he managed to get his money back, a great deal of the stock was left on his hands, and the debtor lost about £200 through depreciation. Subsequently, he suffered a loss of about £500 through bad debts, and last year there was a further loss of £500. Last June, the liabilities to the trade were in the neighbourhood of £2,500, and they had since been reduced to about half that amount. Debtor had suffered through lack of capital and his credit had been curtailed, whilst he had also felt the effect of keen competition. The sales during recent years had been as follows: 1920, £6,000; 1921,

£8,373; 1922, £7,290; 1923, £8,821; and 1924, £7,281. Latterly, the turnover had fallen off, although last year there was a net profit, before allowing for the bad debts, of about £560. The debtor thought that, but for pressure by creditors, and losing an action brought against him, he would have been able to continue trading. It was believed that the business could be continued profitably, and it was suggested that the debtor should be allowed to carry on and pay a composition of 6s. 8d. in the £, spread over a period of twelve months. The cash creditors would stand aside if the offer was accepted. The offer was considered inadequate, and eventually it was decided to confirm the deed already executed to Mr. Pearson, and to accept a composition of 10s. in the £. A committee was also appointed consisting of Mr. E. H. Hawkins, and representatives of Messrs. Drake & Gorham and Messrs. E. Dawson and Co.

Trade Announcements. — Messrs. James Gordon & Co., Ltd., ask us to state that they are now acting as successors to the late Major S. Utting for the sale of the Thermix air heater and Emile Prat systems of mechanical draught.

Messrs. R. Alger & Sons, of Newport, have opened a branch office at 36, Windsor Place, Cardiff.

Fluxite, Ltd., has removed to larger premises at West Lane Works, West Lane, Rotherhithe, S.E.16.

Catalogues and Lists.—Messrs. Herbert Morris, Ltd., Loughborough.—Book 81, containing illustrated details of electric hoist blocks, overhead cranes, and elevators.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, S.E.18.—A priced and illustrated pamphlet (No. 645) advertising "Siemens" h.p. dry batteries.

Newtons' Dynamo Works, Taunton.—A well-illustrated catalogue dealing with the firm's d.c. motors and dynamos, including reports of tests on these machines.

The Hendon Electric Lamp Co., 104, Southampton Row, W.C.1.—A list of reduced prices of "Hendon" electric lamps.

Neocellon, Ltd., Garratt Lane, Wandsworth, S.W.18.—A leaflet describing a non-hygroscopic flame-proof solution for impregnating any porous material. The leaflet itself has been impregnated with "Neoncellon," and will not ignite.

Messrs. J. & W. B. Smith, Ltd., 15-23, Farringdon Road, E.C.1.—A 129-page catalogue of artistic electric lighting fittings of many types—bowls, shades, electroliers, standards, pendants, &c.

Ena Electrical Appliances, Ltd., 62, Englefield Road, N.1.—An illustrated and priced leaflet advertising "Ena" radio transformers.

Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, Essex.—List 91c, a catalogue of inert and dry cells for telegraph, telephone, and radio purposes, &c. Priced and illustrated.

Messrs. J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall.—A pamphlet containing illustrated details of the construction of "Crabtree" quick make and break tumbler switches.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.—A well-produced brochure containing views of a number of buildings in which the company's batteries have been installed.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive List No. 8,115, describing circuit breakers for tramcar service; and Price List No. 5,352, dealing with mining pattern d.c. motor control pillars. Both pamphlets are fully illustrated.

The London Electric Wire Co. & Smiths, Ltd., Playhouse Yard, Golden Lane, E.C.1.—General Catalogue, Section V, detailing the additions to be made to basic prices for insulated round magnet wires, and insulated copper strips and square wires.

Messrs. A. J. Stevens & Co. (1914), Ltd., Walsall Street, Wolverhampton.—An artistically-produced showcard (about 12 in. by 18 in.) advertising the "A. J. S." loud speaker. Also an illustrated price list relating to the same subject.

The Iron & Nickel Battery Co., Ltd., 301, Abbey House, Victoria Street, S.W.1.—A postcard advertising the "Ionic" alkaline electric hand lamp.

Costing Conference.—The fourth annual costing conference of the Institute of Cost and Works Accountants will be held at the Hotel Great Central, Marylebone Road, London, N.W., on Friday, May 1st. Viscount Leverhulme, the president will open the proceedings. At the morning session, the subject "Cost accounting in relation to Industrial Policy, especially having regard to the trend towards price control," will be introduced by Messrs. S. L. Gill, F.C.W.A., A.C.A., and D. L. Moran, F.C.W.A. The subject for the afternoon session will be "Budgetary Control," introduced by Messrs. Perry Keene, F.C.W.A., and F. T. Quennel, F.C.W.A.

The Cologne Autumn Fair.—The authorities of the Cologne International Fair have decided that the Autumn Fair shall be held from September 23rd to October 2nd, inclusive. The special feature of the fair will be the Building Section. The British representative is Mr. W. Dederich, Stanley House, Dean Stanley Street, S.W.1.

The International Lamp Syndicate.—The secretary of the Union des Fabricants de Lampes Electriques Françaises has asked a Paris newspaper to state that a fairly large number of French and foreign makers of electric lamps have not joined the International glow lamp syndicate, the formation of which was recently announced.

Cooking Equipment for a Passenger Boat.—The General Electric Co., Ltd., Magnet House, Kingsway, London, has recently secured in direct competition with the largest Continental manufacturers, an order from the Stoomvaart Maatschappij Nederland, Amsterdam, for the complete electric cooking equipment for their new passenger boat, the *Pieter Cornelius Hooft*, now being built in the South of France. This equipment includes bread-baking ovens, special pancake ranges, milk, coffee and water boilers, hot cupboards, carving tables, &c.

Book Notices.—"Kelly's Directory of the Electrical Industry and Wireless and Allied Trades, 1925." (Pp. xxvii+1199.) London: Kelly's Directories, Ltd. Price 30s., post free.—When this bulky annual made its *début* last year we complained of its incompleteness in certain respects. So far as we can judge, the second edition has been amended in this direction, which certainly increases the value of the work. A new feature is a separate section for Ireland.

"The *Transactions* of the South African Institute of Electrical Engineers." February, 1925. Johannesburg: The Institute. Price 2s.—This issue contains the address of the new president, Mr. H. W. Clayden, A.M.I.E.E., who dealt mainly with the use of electricity in mining. Discussions of previously-published papers are also reported.

Scientific Papers of the United States Bureau of Standards.—No. 457, "Thermal Expansion of Aluminium and Various Important Aluminium Alloys" (15 cents); No. 499, "Investigations on the Platinum Metals, VII. Arc Spectra of the Platinum Metals (4,500 A to 9,000 A)" (10 cents). Technologic Paper of the United States Bureau of Standards. No. 276, "Compressive Strength of Sand-Lime Brick Walls" (10 cents). Washington: Government Printing Office.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIII. No. 340. April, 1925. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Post Office Electrical Engineers' *Journal*." Vol. XVIII. Part 1. April, 1925. London: The Electrical Review, Ltd. Price 2s. net.

"Bauxite and Aluminium," by W. G. Rumbold. Pp. ix+110. London: John Murray. Price 6s. net.

"The Electrolytic Separation of Magnesium from Magnesia." By Ichitaro Namari. Pp. 159+ix; figs. 31. Sakai.—The book is the result of the author's experiments and research on this important subject. Many data are given and also many carefully-prepared curves. The author's outline sketches of his experimental connections, &c., are very clear, and some photographs showing deposited magnesium on the electrolytic cathode are of particular interest.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLIV, April 25th. New York: The Institute. Price $1.

"An Outline of Automatic Telephony," by W. Aitken. Pp. ix+143; figs. 42. London: Ernest Benn, Ltd. Price 5s. net.

Austrian Railway Electrification.—According to *The Railway Gazette*, Herr Guenther, president of the Austrian Federal Railways, has stated in Vienna that during his recent visit to London he succeeded in interesting a leading British banking firm in a projected loan of $22,000,000 to the Federal Railways for the purpose of continuing the work of electrification. Herr Guenther expects that the League of Nations will make possible the realisation of this loan.

Water Exploitation Exhibition at Leipzig. — The *Deutsche Bergwerks Zeitung* says that it is intended to hold a Water Exploitation Exhibition at Leipzig from July 19th to 31st this year. In the technical department there will be an exhibition of the machines, tools, and materials used in the building and working of water plant and waterways, *e.g.*, dams, sluice gates, hydraulic engines, pumps, water wheels, turbines, dredging machines, saws, pipes, &c. All kinds of scientific instruments and every description of literature on water exploitation will be displayed.—*Reuter's Trade Service* (Essen).

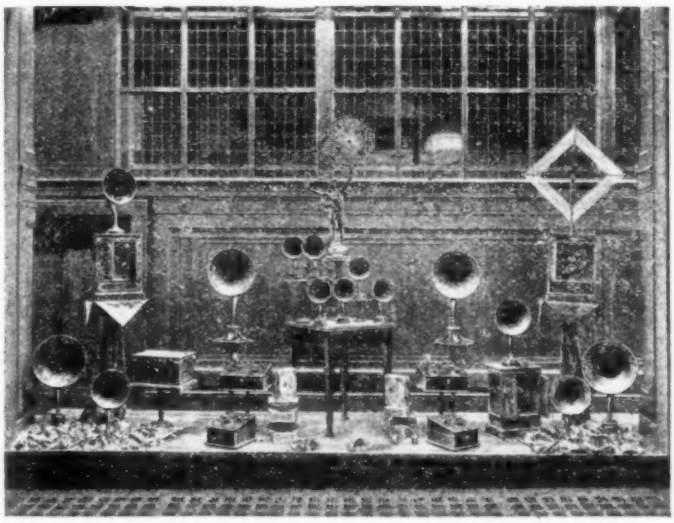
Dublin Electrical Workers' Strike.—Electrical contractors in Dublin have been put to serious inconvenience by a strike of about 100 members of the Electrical Trades Union, who refuse to work with members of the Irish Engineering Industrial Union, no question of wages or of employment conditions arising. The contractors say they cannot support the action of the Electrical Trades Union in excluding electrical workers from their union, except on payment of entrance fee of £25 or £30.

Electrical Trades Commercial Travellers' Association.—A well-attended general meeting of the Association was held at St. Bride's Institute on April 8th, Mr. E. Joyce presiding. The secretary reported that the Association had been unanimously elected a member of the Southern Federation of the British Commercial Travellers' Associations. It was also announced that a number of social functions had been arranged for the coming season. The rules were adopted, and the insurance scheme, after explanation, was approved.

Lead.—Messrs. James Forster & Co. report that the lower prices during the week ended April 18th attracted quite a considerable amount of buying by consumers, who had not only bought early lead, but also made contracts well ahead. "There is little speculative interest at present in the market, but for the moment values look like bottom." The Board of Trade returns for March were:—Imports, 21,710 tons; exports, 1,947 tons; leaving for home consumption 19,763 tons.

New German Cable Factory.—It is reported from Berlin that the new cable factory of the Deutsche Kabelwerke, which has been erected at Ketschendorf, near Furstenwalde, to replace the company's sequestrated English branch, has now been set in operation to the extent of 60 per cent. of its productive capacity, while the completion of the works is being expedited. The company states that inland sales are very active and the prospects of the export trade are favourable in view of the improved conditions of the money market.

Trade Marks in China.—The Chinese Ministry of Agriculture and Commerce has extended to June 20th, 1925, the period within which trade marks qualified according to the terms of Article 4 of the Trade Mark Law can be registered. The advantage of applying for registration under this article, provided the trade mark has been used in China in good faith and uninterruptedly for five years, is that the application is not subject to the same restrictions as a regular application, and the registration is expedited.



A "Sterling" Display at Selfridges.

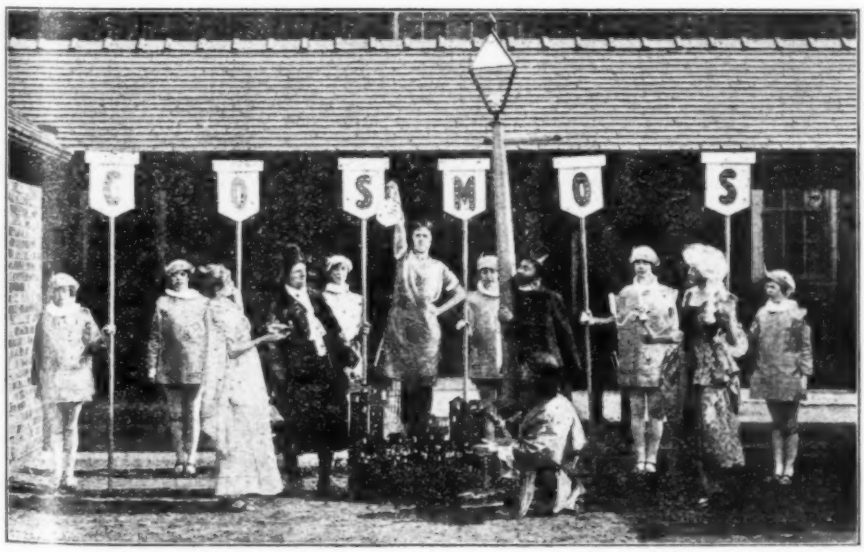
A Sterling Display.—The windows of Messrs. Selfridge's Stores in Oxford Street are noted for their general effectiveness and artistic arrangement. One window was recently devoted to the radio apparatus produced by the Sterling Telephone & Electric Co., Ltd., and the result was well in accord with the general rule, as will be seen from the accompanying illustration. Loud speakers, including the Sterling "Baby" and "Primax" patterns, were the dominant feature, but the other appliances—receiving sets, frame aerial, &c.—were not overshadowed by these, a careful balance having been arranged. The background of the window, a dark panelled wall with leaded "lights," enhanced the value of the display.

Tramway Strike at Manchester.—Negotiations with a view to the settlement of the strike of maintenance men in the tramway departments of Manchester and Salford, which commenced on April 8th, have proved fruitless. An offer of 8s. per week to the electrical workers and 4s. per week to the overhead linemen was made by the Lancashire and Cheshire Local Authorities' Association last week, but this was not accepted. The claim is for 14s. 10d. per week for all of the 160 men affected.

Social Event.—The final match for the Cable Makers' Football Competition Cup was played on Saturday between the Callender and Henley elevens, Callender's winning by four goals to one. The cup was presented in the evening at a dinner held at the Queen's Hotel, Leicester Square, at which Mr. J. S. Huddleston, of the Union Cable Co., presided. The cup, which was suitably inscribed, was toasted for the first time, and a small replica of the cup was presented to the Callender's captain. The rejoicing which was shown both on the field and at the dinner leaves no doubt as to the keenness with which the games for the cup have been fought.

New French Company.—A new company has been formed in Paris (83, Boulevard Gouvion St. Cyr), with a capital of one million francs, and the title La Société d'Etudes d'Appareillage Electriqué Magondeaux, to manufacture lighting dynamos, starters, and other electrical equipment for motor vehicles.

The Met.-Vickers Carnival.—Mr. P. N. Rand, the general sales manager of the Metropolitan-Vickers Electrical Co., Ltd., is a sufficiently well-known figure in the electrical industry to need no introduction, but we are somewhat doubtful whether his many friends and acquaintances would recognise him as attired in the photograph which we reproduce below.



"The Triumph of Cosmos" at the Met.-Vickers Carnival.

"The Bishop of Trafford Park."

Brazilian Railway Contract for Germany.—Concerning the reported intention of the Government of Brazil to place an order with the German electrical industry, an Amsterdam newspaper states that the contract is for the construction of about 250 miles of new railways to be electrically operated. The German group, which is headed by the Siemens-Schuckertwerke, is to carry out the whole of the work of construction and supply all the equipment. The cost of construction is to be defrayed to the extent of 40 per cent. by the issue of shares in a new company to be formed for the purpose, and as to 60 per cent. by deliveries of coffee arising from the new harvest.

Lest it should be feared that Mr. Rand has forsaken the industry for higher things, we should explain that the costume is that worn by him at the M.V. Co.'s great annual carnival recently held at Manchester. It is clear that Mr. Rand's choice of a career has deprived the church of a most striking ornament.

We also reproduce another group which appeared among many others at the carnival and which clearly depicts the triumph of "Cosmos" over primitive forms of lighting which have come down through the ages.

The carnival was a great success and clearly immensely enjoyed by all those present.

Unemployment.—There was a further reduction in the number of registered unemployed during the week ended April 6th, the number at that date being 1,166,300, as compared with about 1,194,300 a week earlier.

Capetown Strike Settlement Terms.—The National Conciliation Council in the building trades, formed as a result of the strike settlement in September last, has decided that the wages of electricians in the Cape Peninsula shall be increased by 2d. per hour, making the wages 2s. 9d. per hour.

Vickers, Ltd.—Speaking at the annual meeting of Vickers, Ltd., on April 15th, the chairman, Mr. Douglas Vickers, said that during the past year the Metropolitan-Vickers Electrical Co., Ltd., was very successful in foreign markets, and was better employed than in 1923. Glover's, too, did well, and were making some extensions to meet the increased demand. Vickers-Petters, Ltd., had been passing through bad times owing to the small demand for medium-sized oil engines. Canadian-Vickers, Ltd., had also had a bad year, owing to the cessation of shipbuilding in Canada and the difficulty of finding work to replace it.

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from April 15th :—

Neutron, the wireless crystal (lettering and design). No. 452,957; Neutron. No. 452,958; and Ultron. No. 454,814. Class 8. Detector crystals for use in wireless telephony.—Neutron, Ltd., Sicilian House, Southampton Row, W.C.1.

Bear brand, best quality (lettering and design). No. 453,466. Class 8. Pocket lamp, flash lamp, and torch lamp batteries.—Nicolai Behr, Sentinel House, Southampton Row, W.C.1.

Wyvern (lettering and design). No. 454,955. Class 8. Wireless telephonic receiving sets.—Fairfield & Co., 42, London Road, Leicester.

Varic. No. 456,309. Class 8. Radio and other telegraphic and telephonic instruments, apparatus, and parts thereof.—Varic, Ltd., 44-46, Castle Hill, Bedford.

Paramount detector "gets it" (lettering and design). No. 456,660. Class 8. Crystal detectors.—Percy Wincour, 42, Cranbourn Street, W.2.

Yeoman. No. 457,017. All goods in class 8.—James William McLane, 46, Doughty Street, W.C.1.

Memrex. No. 456,460. Class 13. Electric switches (ordinary), electric fuses, and electric cut-outs.—The Midland Electric Manufacturing Co., Ltd., Stafford Works, Barford Street, Birmingham.

Kye. No. 456,554. Class 13. Electric lamps (ordinary).—Spencers (Electrical), Ltd., 9, White Cross Place, Wilson Street, E.C.2.

Amploid. No. 454,748; and Amplionite. No. 454,749. Class 50. Celluloid and viscose, sold in sheets, blocks, and slabs, for industrial purposes.—Edward A. Graham, trading as Alfred Graham & Co.

Australian Tariff Preference.—A memorandum issued by the Australian Department of Trade and Customs, setting forth the new preference conditions which came into force on April 1st, was published in the *Board of Trade Journal* for April 16th. This shows that preference will be granted as follows :—(*a*) To goods which are wholly produced or wholly manufactured in the United Kingdom. As to manufactured goods, these will only be considered "wholly manufactured in the United Kingdom" if in the raw materials used and also in the finished goods no manufacturing process has been performed outside the United Kingdom which is being commercially performed in the United Kingdom. The Minister shall determine what are to be regarded as raw materials and in such determination may include partially manufactured Australian materials. (*b*) To goods, not wholly produced or wholly manufactured in the United Kingdom in the terms of paragraph (*a*), provided they contain at least 75 per cent. of United Kingdom labour and/or material in their factory or works cost. (*c*) Notwithstanding anything contained in the preceding paragraphs, to goods of a class or kind not commercially manufactured in Australia provided they contain at least 25 per cent. of United Kingdom labour and/or material in their factory or works cost. (*d*) It is essential in every case that the final process or processes of manufacture shall take place in the United Kingdom, and that the goods are consigned therefrom direct to Australia. With reference to paragraph (*c*) above, an appendix is attached to the memorandum in which are scheduled the goods which are deemed not to be manufactured in Australia. This list includes electric lamps for lighting and heating; telephone apparatus; arc lamps (except for kinematographs); electric vacuum tubes; electrical measuring and recording instruments other than a.c. recording watt-hour meters; flue-heated economisers; and steam traps.

South Africa and Imperial Preference.—From a list published in the *Board of Trade Journal* we are now able to amplify the information given in our last issue under the above title. This list contains 22 items (out of a total of 372) upon which minimum tariffs are being imposed in the case of United Kingdom goods. With the exception of "electric lamp bulbs, radiator type," all classes of electric lamps are to be admitted free of duty, as also are "electric meters," "electric machinery and implements," and "wrought-iron and steel and cast-iron pipes and tubes." Electric heating and cooking apparatus and "electric lamp-bulbs, radiator type," which are ordinarily subject to a 20 per cent. *ad valorem* duty, are to receive a rebate of 5 per cent. *ad valorem*.

Calendar.—We have received from the Metropolitan-Vickers Electrical Co., Ltd., a calendar for the 12 months ending March, 1926. This, following the company's usual practice, bears a portrait of a very pretty girl, a member of the staff.

New Showrooms.—Carron Company has opened new and enlarged showrooms at 123, Buchanan Street, Glasgow. There is a comprehensive display of gas and electric cooking and heating appliances, &c.

The German Electrical Industry.—According to the reports of the Prussian Chambers of Commerce, the revival in the electrical industry continued in March; the inland orders received were favourable, but foreign contracts were exceptionally difficult to obtain. Sale prices are said to be slowly rising. The electricity works are undertaking supplementary and extension works, and as a consequence large orders have been booked for cables and for other work. New orders were also due to the electrification of the Reich railways, although operations are only proceeding very slowly owing to the scarcity of capital

Local Exhibitions.—Fleetwood.—Arrangements are being made by Mr. W. P. Lilwall, electrical engineer of Fleetwood, for a local exhibition of electrical appliances.

Liverpool.—On April 18th, an Ideal Homes and Wireless Exhibition was opened at the Philharmonic Hall.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, April 21st :—Copper (electrolytic) bars, £63 10s., 30s. decrease; do., do., sheets, no change; do., do., wire rods, £73 10s., 30s. decrease; do., do., h.c. wire, 9¼d., 3/16d. decrease.

Messrs. James & Shakespeare report, April 22nd :—Copper bars (best selected), sheet and rod, £89, 20s. decrease; English pig lead, £32 5s., 30s. decrease.

Swiss Aluminium Industry.—At the annual meeting in Zurich on April 8th of the Aluminium Industry Co. of Neuhausen, it was stated that the development of the undertaking was proceeding satisfactorily as a consequence of the growing consumption of aluminium. It was proposed to increase the productivity of the company by the erection of a new manufacturing centre at an estimated outlay of 6,000,000 fr., which was to be raised by an increase in the share capital. It was further mentioned that, as a consequence of the extraordinarily high taxes, which amounted to 3,000,000 fr. in 1924, as compared with 1,300,000 fr. in the previous year, and represented 26.5 per cent. of the net profits, it would be necessary to reorganise the company and possibly convert it into a holding company.

The Latour Radio Patents.—The American Telephone and Telegraph Co., the Postal Telegraph Co., the Radio Corporation of America, and the Freed-Eisemann Radio Corporation have all made agreements with Dr. Marius A. Latour, of Paris, giving them the legal right to the use of basic radio inventions. Dr. Latour has waived claims for infringement. His inventions date back many years, and cover the radio art so well that it is virtually impossible to build a receiving set to-day without infringing one or more of his patents. Dr. Latour was employed as an engineer by the General Electric Co. at Schenectady from 1904 to 1911, and is said to be now receiving royalties from various other patents. The Hazeltine Corporation has obtained control of the corporation recently organised to exploit the inventions of Dr. Latour. The patents are controlled by the Hazeltine Corporation, subject to the licences which have been previously acquired by the above-mentioned companies. In addition, the corporation has purchased all radio inventions which Dr. Latour may make in the next five years.—*Electrical World.*

For Sale.—Southampton Corporation Electric Supply Department has for disposal one 300-kW Parsons steam turbine, direct-coupled to an Electrical Construction Co. alternator, surface condenser, &c. The Liquidator of Messrs. Weller and Gibson, Ltd. (in voluntary liquidation) invites offers for the stock at 31, King Street, Tower Hill, E.1, consisting of electric lamps, wireless receiving sets, and electrical accessories. Dewsbury Corporation Electricity and Tramways Department invites offers for two Willans compound engines coupled to 100-kW Bruce Peebles generators, &c. Messrs. A. T. Waller and Co. will sell by auction, at 5a, Bridgwater Square, E.C., on April 29th, the salvage stock of insulators, switches, battery cases, electrical goods, &c. Charing Cross Electricity Supply Co., Ltd., has for disposal one 350-kW synchronous motor-generator; one 10,000-V alternator, direct-coupled to two 100-V, d.c. machines. Messrs. Fuller, Horsey, Sons & Cassell will sell by auction at the Baltic Exchange, E.C., on May 8th the gas-electric power plant standing at Purfleet. Hornsey Corporation electricity department invites offers for surplus generating plant. (See our advertisement pages this week.)

New Australian Companies.—The Electrical and Wireless Company of Newcastle, Ltd., has been registered with a nominal capital of £5,000 in 5,000 £1 shares. The object of the company is to take over the business carried on by the Wireless Company of Newcastle (N.S.W.).

Electric Supplies and Engineering (Australia), Ltd., has been formed with a capital of £10,000, to carry on the business of electricians, electrical and mechanical engineers, and manufacturers of, dealers in, and contractors for all plant, machinery, apparatus, &c.

Motor-car Equipment.—In connection with the endeavours that are being made to improve the service with regard to the electrical equipment of motor-cars that repairers are able to render to their customers, the Lucas Electrical Co., Ltd., of Birmingham, has inaugurated a school to which owners of repairing establishments may send their employés for a course of instruction in the method of dealing with Lucas electric-lighting and engine-starting sets.

Manchester Crane Drivers' Strike.—Drivers of electric cranes in the Manchester and Salford district ceased work on April 18th owing to the failure of negotiations, which have been in progress since December, in connection with a demand for increased wages

Finnish Electrical Imports.—The official statistics of the foreign trade of Finland during 1923 show that 1,400 metric tons of electric generators, motors, &c., valued at 26,454,000 Finnish marks, were imported. Insulated wires and cables to the extent of 1,100 tons, valued at 13,479,000 marks, and incandescent lamps to the value of 16,526,000 marks (100 tons) were also imported.

Finnish Tariff Alterations.—Under the new Customs tariff which lately came into operation in Finland, the import duty on electrical machines, such as generators, motors, converters, transformers, &c., weighing not more than 500 kg. net, has been altered from 5 to 7 Finnish gold marks per kg.; and that on galvanic elements from 1.20 to 2.50 marks per kg. Parts of special electro-technical apparatus, not otherwise specified, are dutiable at 6½ marks per kg.

Liverpool Radio Retailers' Association.—This recently-formed association held its second meeting on April 16th, Mr. J. Dumbrell presiding. The main business was approving of the draft rules and constitution. One of the questions discussed was the obtaining of trade discounts by unauthorised persons. It was suggested that orders from wireless dealers should bear the official sign of the Association. This would be a clear indication to the factor that it was a *bond-fide* trade order. The chairman said that if this action were approved and they obtained the support of the wholesalers and factors, it would be an effective means of cutting out a lot of people who bought parts, and assembled sets, which were afterwards sold in competition with the products of the wireless trader.

Visit to Automatic Telephone Works.—On April 7th, the Lord Mayor of Liverpool (Alderman T. Dowd) and the Lady Mayoress paid a visit to the works of the Automatic Telephone Manufacturing Co., Ltd., Milton Road, Edge Lane, Liverpool. They were received by the chairman of the company, Sir Alexander Roger, and his co-directors, Sir Max Muspratt, Bart., and Messrs. James Taylor and Dane Sinclair. Mr. G. W. Moore, the manager, and Mr. J. Nixon, works manager, were also in the party which conducted the visitors round the works. As a memento of the occasion, the Lord Mayor was presented with a small-scale model of a "Strowger" desk telephone and the Lady Mayoress with an "Xcel" silver-plated kettle.

Lighting and Power Notes.

Aberdeen.—SCHEME APPROVED.—The Electricity Commissioners have approved of the extension of the Corporation power station, and have sanctioned the borrowing of £198,199 to cover the cost of the extension.

Argentina.—BUENOS AIRES.—The Compania Hispano Americano de Electricidad, which provides electric light and power to the city of Buenos Aires, has petitioned for a concession to build a new power house with a capacity of 142,500 kW in the vicinity of the new port.

Barnes.—ELECTRICITY IN BULK.—The Lighting Committee has applied to the following companies for quotations for a bulk supply of electricity:—The Metropolitan Electric Supply Co.; the County of London Electric Supply Co.; the Southern Railway Co. The Metropolitan Electric Supply Co. has submitted a price, but the Southern Railway Co. has intimated that it is unable to enter into negotiations with the Council for a supply. No offer has yet been received from the County of London Electric Supply Co. The Committee has adjourned consideration of the matter, and has instructed the electrical engineer in the meantime to communicate with the Fulham and Hammersmith Councils.

Barnsley.—LOANS SANCTIONED.—The Town Council has received sanction to the following loans:—£5,000 for mains and services; £1,560 for meters.

Bedford.—ELECTRICITY SUPPLY.—In connection with the opposition to the Bedfordshire, Cambridgeshire, and Huntingdonshire Electricity Bill, a conference has been held between representatives of the Electricity Committee and members of the Electricity Committees of the Luton and Peterborough Corporations. The Bedford and Luton representatives agreed that if the circumstances should render it desirable they would recommend their Councils to seek powers in due course to add to their areas of supply the portion of the county of Bedford lying between such areas. Luton Corporation has confirmed the agreement, and the Bedford Electricity Committee has recommended a similar course.

LOAN.—The Electricity Committee recommends that application be made for sanction to a loan of £7,500 for services.

Carlisle.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £5,175 for mains.

Continental.—GERMANY.—It is reported from Berlin that the Deutsche Wasserkraft Bank at Munich is negotiating with an English financial consortium for a loan of £1,000,000 to develop water-power resources.

BELGIUM.—The Société du Chemin de Fer Electrique d'Ostende-Blankenberghe et Extensions reports that the sales of electricity from its central station at Slykens last year amounted to 12,506,000 kWh, an increase of 18 per cent. over 1923. A more rapid progress is anticipated for the current year, as the company has secured the contract for the supply of the energy required for the distribution system which is being established by the West Flanders Provincial Council, and will embrace the whole of the north-west portion of the province. In order to meet the growing demand the Ostend Co. has ordered a further turbo-generator which will bring the capacity of the power station up to 14,000 kW.

Dover.—ELECTRICITY AGREEMENT.—An agreement has been arranged between the Town Council and the Folkestone Electricity Supply Co., Ltd., for connecting up the two electricity works by a cable for mutual supply. The agreement has been sanctioned by the Electricity Commissioners.

East Ham.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to a loan of £2,178 for the extension of electricity mains.

MAINS EXTENSIONS.—The electrical engineer has prepared estimates of £5,846 for the supply and laying of feeder cables from the generating station to Bruges Road and Plashet Grove.

Grange.—ELECTRICITY SUPPLY.—The Urban District Council has sealed an agreement with Barrow-in-Furness Corporation for a supply of electricity.

Gretna.—PURCHASE OF PLANT.—At a recent public meeting of residents it was decided to offer the Disposal Board £6,004 for the electrical plant at Gretna. It was feared the supply would be cut off, but the decision to purchase will obviate this.

Heckmondwike (Yorks.). — ELECTRICITY SCHEME. — The Urban District Council's electricity undertaking is to be formally re-opened on April 25th as a distributive sub-station, electricity being obtained in bulk from the Yorkshire Electric Power Company, instead of being generated at the station as formerly. The works have been receiving an a.c. supply from the Power Co. since December last at a pressure of 11,000 V, which is transformed into d.c. for distribution.

Helensburgh.—ELECTRICITY SUPPLY.—The Town Council has arranged with the Clyde Valley Electrical Power Co. for the introduction of electric lighting to the town, and the work of laying the cables will commence immediately.

Hereford.—LOANS.—The Town Council has received sanction to loans of £2,000 for services, and £276 for a new cable in Linden Avenue. Application has been made for sanction to loans of £5,894 for a duplicate cable for the waterworks, and £5,677 for the relaying of mains.

India. — HYDRO-ELECTRIC DEVELOPMENT. — Sir Malcolm Hailey, the Governor of the Punjab, performed, in the last week of March, the opening ceremony of the hydro-electric power station installed by Sir Gangaram of Lahore on the Lower Bari Doab Canal at a cost of nearly Rs. 30 lacs.

The Government of Madras some time ago engaged the services of Mr. Forbes, electrical expert to the Mysore State, to examine the hydro-electric resources of the Madras Presidency and to formulate schemes. The scheme submitted requires a total capital of Rs. 9 crores for developing the principal resources of the Presidency, including the Pykara project on the Nilgiris, which will cost Rs. 3 crores, and the Periyar project, which will cost about Rs. 2½ crores. As it is not possible to get the capital required in the Province, the Madras Government intends taking advantage of the Imperial Trade Facilities Act, and with that view to start a registered company, the interest on the capital of the company to be guaranteed by the British Government and the Madras Government in the proportion of 75 and 25. If the scheme materialises, the South Indian Railway may be electrified.

King's Lynn.—NEW PLANT.—The electrical engineer has submitted a report to the Town Council, recommending the installation of the following plant:—One 2,000-kW turbo-generator, complete with condensing plant, pipework, and foundations, £12,500; one 750-kW motor-converter, complete with switchgear, cabling, &c., £4,500. Mains extensions are also recommended at a cost of £1,595. The report has been approved, and application is to be made for sanction to borrow £18,595 to cover the cost of the work.

London.—ISLINGTON.—The Electricity Committee has now prepared a development scheme in connection with the proposed linking-up with the electricity undertaking of the Hackney and St. Pancras Borough Councils. The extensions are estimated to cost £139,400, and it is proposed to purchase a 10,000-kW turbo-alternator, condenser, transformer, switchgear, &c., and to provide a 50-ton crane.

Sanction has been received to loans of £16,325 for mains, services, meters, and transformers, and £6,240 for mains and switchgear in connection with the Highbury New Park feeder.

HACKNEY.—The Borough Council is applying for sanction to the borrowing of £13,772 for the purchase of four 1,000-kW converters in connection with the erection of sub-stations at Holy Street and Gainsborough Road.

ST. PANCRAS.—The Electricity Committee has recommended to the Borough Council that additional feeder mains be installed, together with the necessary test wires, at an estimated cost of £9,100, and that application be made for sanction to the borrowing of this sum. The electrical engineer has reported the need for additional converting plant at the Highgate and Grafton Road sub-stations. He recommends that the three small motor-generators at present installed should be disposed of and two 1,000-kW motor-converters installed. He also proposes that one 1,000-kW motor-converter be installed at the Grafton Road station. The cost of the scheme, including the provision of the necessary switchgear, is estimated at £17,135, and the Electricity Committee has recommended that, subject to sanction being received from the Electricity Commissioners, the work be carried out.

Lowestoft.—Loan Sanctioned.—The Town Council has received sanction to the borrowing of £4,000 for mains and services.

Maybole.—Electricity Scheme.—The Town Council proposes to ask the Ayrshire Electricity Committee to introduce electricity to the town. Factory owners, &c., are desirous of obtaining a supply.

Paisley.—Street Lighting.—The Town Council has approved of schemes for the lighting of additional streets by electricity. It has also been agreed that eventually the whole town shall be lit by electricity, schemes for the various districts to be submitted from time to time.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

East Ham.—Heating and cooking: From 1½d. to 1d. per kWh during the summer quarters.

Keighley.—Lighting: Flat rate, 6d. per kWh for the first 500 kWh per quarter; over 500 kWh, 5d. Heating and cooking: Flat rate of 1½d. per kWh. Small power users: First 1,250 kWh per quarter, 3d.; above this amount, 2d. per kWh. A fixed quarterly charge has been introduced according to the number of points installed, plus a flat rate of 1d. per kWh.

Wakefield.—Lighting: Reduction of ¼d. per kWh. Heating and cooking: ¼d. per kWh. Power: Consumers supplied in bulk on a kVA basis, ⅛d. per kWh. Large power consumers supplied on the scale, from 62½ per cent., to 52½ per cent. over pre-war charges. Small power consumers, from 80 per cent. to 65 per cent. over pre-war charges. Kinemas: From 87½ per cent. to 72½ per cent. above pre-war charges.

Weymouth.—Contract rate: From 2d. to 1½d. per kWh. Cooking on the Council's housing estates: 2d. per kWh, this charge to include cost of hire of cooker and necessary wiring.

Torquay.—The Town Council has reduced the standard price per kWh from 1¾d. to 1½d., and lowered the maximum power rate from 3¾d. to 3½d. per kWh.

Southampton.—Lighting: Within the borough, varying from 4½d. to 3d. per kWh, according to quantity consumed; outside the borough, 5d. and 3½d. per kWh. Heating and cooking: Within the borough, 1½d. per kWh; outside the borough, 1¾d. per kWh. Power and motor-generators for lanterns in kinemas: Within the borough, varying from 1¾d. to 1½d. per kWh; outside the borough, varying from 2d. to 1¾d. per kWh. Accumulator charging: 1½d. and 1¾d. per kWh respectively.

Ramsey (Isle of Man).—Electricity Scheme.—The Town Commissioners have decided to proceed with a municipal scheme for the supply of electricity to the town.

Special Orders. — Applications have been made to the Electricity Commissioners for Special Orders to supply electricity in the following districts:—Certain townships in the rural districts of Burnley, Clitheroe, and Blackburn, by the Lancashire Electric Power Co.; in the urban district and parts of the rural district of Petersfield by the Petersfield Electric Light and Power Co., Ltd.; in the boroughs of Shaftesbury, Bridport, and Chard, the rural districts of Shaftesbury, Sturminster, Wincanton, Bridport, Beaminster and Chard, the urban districts of Crewkerne, Ilminster and Axminster, and certain parts of the rural districts of Shepton Mallet, Blandford, Langport, and Axminster, by Mr. J. Campbell Robertson.

Stafford.—Electricity Extensions.—The Electricity Committee has recommended to the Town Council that coal-handling plant be provided at a cost of £4,970, and that water ducts be constructed at a cost not exceeding £7,200. The recommendation has been approved.

Stretford.—Electricity Accounts.—Reporting on the Urban District Council's accounts, the auditor states that the electricity undertaking shows a gross profit of £82,929 and a net profit on the year's working of £38,088. The reserve fund for renewals, obsolescence, and breakdown of machinery amounts to £50,000.

Sunderland.—Street Lighting.—The Town Council recently considered the merits of electricity *versus* gas for street lighting, and it was stated that whereas the cost of electric lighting had decreased to £3 15s. per lamp, the cost of gas lighting had gone up to £4 9s. per lamp. The Council has instructed the Highways and Electricity Committees to report at an early date on the question of extending the electric lighting throughout the whole of the streets of the borough.

Loans Sanctioned.—Sanction has been received to the following loans:—Extension of plant, £49,148; mains, £9,501.

Swansea.—Loans.—The Town Council is applying for sanction to the following loans:—£10,000 for mains for public lighting; £5,000 for meters.

New Sub-station.—The Council is to erect a sub-station at Mannesmann Corner, and lay a main from the Strand station to the sub-station, at an estimated cost of £6,210.

Thorverton (Devon).—Electricity Scheme.—Miss Haslett, director of the Women's Electrical Association, London, recently addressed a public meeting in connection with the proposed electricity scheme. She spoke of the rapidly extending uses of electricity for all domestic purposes, and a resolution was carried supporting the scheme, and a small committee was elected to carry out preliminary arrangements. Two separate proposals were before the meeting, one being detailed by Mr. Hurst, engineer of the Teignmouth Electrical Supply Co., and the other by Mr. Newbery, owner and manager of the Exton Electricity Works.

Torquay.—Loan.—The Town Council is applying for sanction to borrow £47,443 for extensions and new plant at the power station.

Wakefield.—New Plant.—The Electricity Committee has decided to purchase a 1,000-h.p. 3-phase motor, complete with gear, to drive an 800-kVA alternator, at an estimated cost of £2,500.

Loan Sanctioned.—The Electricity Commissioners have sanctioned a loan of £4,120 for mains, &c., in connection with the supply of electricity to Alverthorpe and Flanshaw and a main between Sandal and Thornes.

Watford.—Electricity Supply.—At a recent meeting of the Electricity Committee, the electrical engineer reported having been in communication with the North Metropolitan Electric Power Supply Co., and suggested that the Corporation should consent to the company's applying for an Order to supply in Boreham Wood and Elstree in the Corporation's area of supply, the company on its part consenting to the Corporation's applying for an Order to supply in Bushey Heath, which is in the company's area of supply. The Committee has approved of the arrangement.

The company has secured permission to lay a main from Elstree to St. Albans.

West Midlands Electricity District.—Order of Constitution.—With reference to the local inquiry at Wolverhampton on December 16th last in respect of the draft Order for the reorganisation of the supply of electricity in the above-named district, after consideration of the representations made to them, the Commissioners have made an Order giving effect to the scheme. The Order has been submitted by the Commissioners to the Minister of Transport for confirmation.

S.E. Lancs. Advisory Board.—Ald. W. T. Dagnall has been appointed chairman of the South-East Lancashire Electricity Advisory Board, with Mr. C. D. Taite as vice-chairman. The members of the Board, as well as the Engineering Advisory Committee and the Finance Committee, have been elected for the year ending March 31st, 1926. The energy generated under the supervision of the Board last year amounted to 802,022,626 kWh, as compared with 693,854,809 kWh in 1923. The annual report is being prepared.

Tramway and Railway Notes.

Bradford.—Year's Working.—During the year ended March 31st last the Corporation tramways and railless cars carried 100,150,739 passengers, an increase of nearly 7½ millions. The total receipts were £649,366, an increase of £9,627.

Brazil.—New Electric Railway.—A meeting of capitalists and agriculturists was recently held at Nepomuceno in the State of Minas Geraes, to discuss the organisation of a company to construct an electrified branch line from Nepomuceno to Lavias. As an initial step in the construction of this proposed line, a company was formed to take over the Empreza de Forca e Luz (Light and Power Co.). It is reported that the required capital has been almost entirely subscribed.—*Commerce Reports.*

Continental.—Austria.—The work of the electrification of the Arlberg railway is now nearing completion, and it is expected that electric trains will be running over the whole line between Innsbruck and Bludenz before the end of May.—*Reuter* (Vienna).

Japan.—Tokio.—According to *Eastern Engineering*, the construction of an underground railway system for Tokio is practically assured. The Department of Railways held a final meeting recently, and adopted a revised plan which calls for four lines. They will form a network throughout the city, comprising about fifty miles of underground railways. The cost has been estimated at £20,000,000.

Rochdale.—Year's Working.—The working of the tramway undertaking of the Corporation for the past year has resulted in a net surplus of £7,068, as compared with £9,587 in the previous year, which has been placed to the reserve fund for renewals.

United States.—New "Underground" Cars.—A new type of subway car, equivalent to two of the type at present in use, is provided for in plans and specifications for new cars costing between 3,000,000 and 4,000,000 dollars filed by the Brooklyn-Manhattan Transit Co. with the Transit Commission for approval. The new car is made up of three car bodies permanently united and mounted on four trucks. The company has four of these cars already under construction.—*Reuter's Trade Service* (New York)

New Electric Railway.—According to *Electric Traction*, final arrangements have now been made to obtain the sanction of the Missouri Public Service Commission for the construction of an electric railway by the St. Louis-Kansas City Short Line Railroad Co. It has presented to the Commission its right-of-way grants through which the proposed electric line will operate between St. Louis and Kansas City. The new route will cover 238 miles. A safety advantage of the new railroad will be the crossing of only two lines on the entire route.

Telegraph and Telephone Notes.

Brazil.—WEATHER REPORTS.—The use of wireless for the interception of weather reports is rapidly increasing. The director of the Weather Bureau at Rio de Janeiro has arranged for the installation of Marconi apparatus for the reception of the meteorological reports which are transmitted from many of the world's large radio stations. The receiver is of the RP 4B type, which is portable and self-contained in a teak travelling case. Tuning is effected by a single circuit, which makes it flexible and easy to operate; the wavelength range is from 1,000 to 25,000 metres, and the intervalve coupling being on the resistance-capacity method, there is no optimum wavelength even over such a long wave range. Suitable for the reception of spark, continuous-wave, or telephone signals, the set has five valves, one being for reaction, two for high-frequency amplification, one detector, and one low-frequency magnifier. For continuous-wave reception the auto-heterodyne method is employed by means of the reaction valve circuit.

China.—RADIO CONTROVERSY.—The subject of radio-telegraphy is again to the fore. According to *The Times Trade and Engineering Supplement*, America continues to press for the right to construct installations as provided for in the Federal contract, and Japan continues to protest that such construction would be a violation of the Mitsui contract. The Japanese, however, now appear to be willing to admit international operation of the Mitsui station, for the benefit of China, provided the Americans agree to forego their claims to a separate establishment, but the Americans seem to be determined to have their own stations. The Mitsui Co. has fulfilled its contract with China by constructing a high-power station near Peking. Communication with the rest of the world has been satisfactorily established, but public traffic has been delayed because the controversy has not yet been settled. The Japanese contract was signed in 1918 and the first American contract in January, 1921.

Germany.—ATLANTIC CABLES.—The German Atlantic Telegraph Co., of Berlin, which is restoring its American cables in connection with agreements entered into with the Commercial Cable Co. and the Western Union Telegraph Co., reports a surplus of 7,799 marks for 1924 and a dividend at the rate of 6 per cent. on the preference shares. The Emden-London cable scheme was carried out in February, 1924, and the directors report that the receipts have corresponded to expectations. An increase in the revenue is expected this year, as telegrams to Portugal and Spain and other Mediterranean countries can now be sent *via* this cable. The Emden-London cable was the precursor of a cable to Vigo, and it will only be used as an auxiliary after the establishment of this connection. The Spanish Government has granted a concession for the Emden-Vigo cable, but its laying will be delayed for some time until the Emden-Horta cable has been completed; a concession for this has been obtained from the Portuguese Government.

Marconi Radio Service.—NEW MANCHESTER OFFICE.—A radio-telegraph office was opened at Manchester on April 20th for the acceptance and delivery of Marconigrams. The office, at 9 and 13, Miller Street, is in communication, by means of a private telegraph line, with the Marconi main telegraph office in London.

New Radio Station.—CORNWALL SITE.—The erection of the new Marconi wireless station at Innis Downs, near Lanivet, Cornwall, is to be commenced at once. Two hundred men are to be drawn from the St. Austell, Newquay, and St. Colomb Labour Exchanges, and work is expected to last about six months.

Radio-Telegraphy.—EUROPEAN CONFERENCE.—The Radio-Telegraphic Sub-Committee of the League of Nations' Transit Commission considers it desirable to call a conference of all European States in 1926. The principal object, says the *Morning Post*, would be to utilise the results of the Telegraphic Union Conference arranged for next September by the French Government and prepare the work for another conference, which the American Government intends summoning in 1927, to revise the Radio-Telegraphic Convention of 1912. The European conference would deal with all questions not figuring on the agenda of the Washington Conference, and with subjects of particular interest to Europe, such as radio-telephony. The Washington Conference is to work out international conventions on radio-telegraphic communication for security at sea and the protection of shipping.

PARIS CONGRESSES.—Two international congresses devoted respectively to the legal and the practical aspects of wireless telegraphy held their first combined gathering in Paris last week, when the members were welcomed by M. Edouard Belin, President of the French Radio Club, and General Ferré, Chief Inspector of Military Telegraphy. The congress of jurists is devoting itself to the study of the juridical *régime* to be adopted in connection with radio communication. The subjects discussed include the problems of the rights of senders and receivers and State control. In this connection the Dunkirk Chamber of Commerce has just sent a petition to Parliament urging that all proposals tending to establish State control over radio-electric sending stations should be rejected.

Transatlantic Telephony.—POSTMASTER-GENERAL'S STATEMENT.—Regarding the statements in the *Morning Post* to the effect that two-way telephonic communication has taken place between England and America by means of a new secret radio system, the Postmaster-General desires it to be known that this is not the case. He points out that the experiments so far made are a continuation of those announced in May, 1924, and that the system is familiar. Two-way experiments cannot be undertaken until the Rugby station is completed.

Radio Notes.

Aerials.—PORTSLADE BAN.—The Ministry of Health has refused to incorporate in its general insurance of houses erected under local housing schemes any responsibility for damage by fire or lightning caused through wireless aerials, says the *Daily Mail*. This decision has been communicated to the Urban District Council of Portslade, Sussex. Owing to the Ministry's refusal, the Council has decided to forbid the erection of aerials on the 62 new houses built under its housing scheme on the score that the cost of insurance should not fall on the ratepayers. The Ministry has also refused to make any grant or to sanction expenditure by local authorities for repairing any damage caused by aerials to houses erected under its housing schemes.

Canada.—NEW BROADCASTING STATION.—The Canadian National Railways are establishing a radio broadcasting station on Lulu Island, which when completed will be one of the most powerful on the Pacific Coast of North America. Trans-Pacific liners will be kept well posted with the latest Canadian news.—*Reuter* (Ottawa).

Czecho-Slovakia.—NEW STATION.—The Minister for Posts and Telegraphs is negotiating with a view to the erection of a high-power broadcasting station at Prague. Since the special radio exhibition held at Prague in connection with the Spring Fair, interest has increased and the number of receiving licences granted has been growing.

India.—BROADCASTING SERVICE.—Our Indian correspondent reports that in a communiqué the Government of India states that it is prepared to grant a licence to private enterprise for a broadcast service, if a company can be registered for the purpose with rupee capital of which at least 60 per cent. must be offered for subscription in India and with a majority of directors resident in British India. The company must be prepared to undertake services throughout British India by means of stations to be erected within British India at such places as the company and the Government shall agree upon from time to time. The licence will be granted for a period of 10 years from the date of commencing a regular broadcasting service from at least one station. During this period, the Government will pay to the company a share of all fees received by the Government in respect of licences. No restrictions will be imposed upon, and no monopoly will be permitted, as regards the manufacture and sale of apparatus. Receiver licences will be issued from head post offices on demand without restriction; the annual fee for each licence will be Rs. 12, of which Rs. 10 will be the share accruing to the authorities providing the broadcast service. The Government of India is further prepared to consider, if necessary, the formation of a separate company to provide broadcasting services for Burma subject to the same conditions.

Peru.—BROADCASTING SERVICE.—It is reported that a radio broadcasting service was to commence in Peru last month.

Sweden.—RADIO BOOM.—According to *Commerce Reports*, in Goteborg alone there were sold during January about 11,000 crystal receiving sets, 30,000 headphones, 4,000 valves, and almost 1,000 complete valve receiving sets, together with a large quantity of other parts of all kinds, the total sales amounting in value to almost 1,000,000 crowns. About 4,000 radio licences have been issued.

United States.—BROADCASTING AT SEA.—An interesting experiment was made by Mr. Fred Mann when he crossed to England in the United States liner *President Harding* recently. Mr. Mann's establishment, the Rainbo Gardens, a large and well-known restaurant and dance palace in Chicago, is equipped with a radio broadcasting station (WQJ), and during his voyage Mr. Mann received on board the ship, from the second day the liner was out at sea and for five successive days and evenings, the nightly programme from the Rainbo Gardens, as well as personal messages and communications in connection with his business. Mr. Mann radioed every evening the position of the ship and interesting events on board, which were relayed by his broadcasting station, WQJ.

FADING.—By listening throughout a 10,000-miles railway tour through the United States, Canada, and Mexico, which will last for a month, members of the Brooklyn Chamber of Commerce hope to find the causes of fading and alteration of signal strength experienced during summer weather, reports the *Evening News*. Although railway travel imposes limitations on reception, the party will never be out of reach of a broadcasting station.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdeen.—April 28th. Aberdeen Harbour. Permanent-way materials for dock railways, *viz.*:—Steel rails and guard rails, steel fishplates. Specification from Mr. R. Gordon Nicol, engineer, Harbour Engineer's Office, Aberdeen.

Australia.—SYDNEY.—May 4th. Municipal Council. 5,000-V potential transformers.

July 8th. New South Wales Government Railways. Two coal elevators and the maintenance of the whole equipment for 12 months.*

Belgium.—May 13th. General Direction of the Belgian Ministry of National Defence, 10, Rue de Meridien, Brussels. Telephone cable. Particulars (Cahier des Charges Special No. 543) for 4 fr.

Bournemouth.—May 21st. Tramways Department. Two 750-kW geared turbines and d.c. generators, complete with condensing plant. (April 17th.)

Bristol. — May 12th. Electricity Department. Two water-tube boilers complete. (April 17th.)

Cardiff.—May 20th. Rural District Council. Switchgear equipment and e.h.p. and l.p. cables. (See this issue.)

Carlisle.—April 27th. Electricity Department. Steam, feed, blow-out and other steel pipework. (April 10th.)

Finland.—HELSINGFORS.—June 1st. Finnish Water Power Department. Two 75-ton overhead travelling cranes, electrically operated.*

Gillingham.—May 9th. Electricity Department. Two 825-kVA, 3-ph. static transformers, two 11,000-V, 3-ph. mains, one regulating transformer, e.h.p. and h.p. 3-phase switchboard. (See this issue.)

Glasgow.—April 29th. Electricity Department Supply of c.i. boxes, section pillars, &c., for 12 months. Mr. R. B. Mitchell, engineer, 75, Waterloo Street.

Hindley.—April 27th. Urban District Council. Platt Low Level Sewerage Scheme. Electric motors, pumps, &c. Particulars from Mr. O. P. Abbott, surveyor, Council Offices.

India.—April 28th. India Store Department. Electric ceiling fans. April 30th. Porcelain insulator cups. May 5th. 150-kVA steam-driven alternator sets, a.c. and d.c. switchboards for power station. (April 10th.)

Ilford.—April 28th. Electricity Department. Supply of 660-V paper-insulated cables. (April 17th.)

London.—METROPOLITAN ASYLUMS BOARD.—April 27th. Installation of electric lighting, new main switchboard and power cables, &c., at the Grove Park Institution, Lee, S.E. (April 10th.)

May 20th. General engineering work, installation of four new Lancashire boilers, fuel economiser, brickwork settings, laundry machinery and plant, electrical generating plant, motors, and power wiring at the Leavesden Mental Hospital, King's Langley. (April 17th.)

OXFORD STREET, W.—April 29th. Tenders are invited from registered London contractors for the electric lighting and power wiring, switchboards, &c., at premises in Oxford Street, W. (See this issue.)

New Zealand.—WELLINGTON.—June 9th. Post and Telegraph Department. Metallic two-wire plugs for telephone switchboards.*

Stoke-on-Trent.—Electricity Department. Plant and materials for a water-pumping scheme, including pumps, cast-iron piping, valves, chlorinating plants, &c. (April 17th.)

Wigan.—May 25th. Board of Guardians. One electrically-driven vertical pumping plant, heating and domestic hot water supply apparatus, alterations to buildings, &c. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barking.—Tramways Committee. Accepted:—
Rails for track renewal (£101).—Bolckow, Vaughan & Co.

Glasgow.—Housing Committee. Recommended:—
Completion of electric light installation at Knightswood housing scheme (£5,400).—R. J. Sinclair.

Library Committee. Recommended:—
Installation of electric light at Whiteinch Library (£430).—Haddow & Co.

Statute Labour Committee. Recommended:—
Repair of electric goods lift at 10, Woodlands Road (£115).—Waygood Otis, Ltd.

Government Contracts.—The following Government contracts were placed during March, 1925:—

ADMIRALTY, CONTRACT AND PURCHASE DEPARTMENT.

Alternators, motors, and spare parts.—W. Mackie & Co.; Newton Bros. (Derby), Ltd.
Ammeters.—Everett, Edgcumbe & Co., Ltd.
Bells, &c.—D. H. Bonnella & Sons, Ltd.; Chadburn's (Ship) Telegraph Co., Ltd.; Foster Engineering Co., Ltd.; General Electric Co., Ltd.; Hawkers, Ltd.; W. McGeoch & Co., Ltd.; W. R. Sykes Interlocking Signal Co., Ltd.
Boxes (electrical, various).—Basebe, Sadler & Co.; Edison Swan Electric Co., Ltd.; Engineering and Lighting Equipment Co., Ltd.; Foster Engineering Co., Ltd.; Hawkers, Ltd.; Johnson & Phillips, Ltd.; W. McGeoch & Co., Ltd.; Player & Mitchell; L. Weekes, Ltd.
Cells.—Chloride Electrical Storage Co., Ltd.
Electro-mechanical firing gear.—Foster Engineering Co., Ltd.
Fuseboards.—Bertram Thomas.
Fuseholders.—L. Weekes, Ltd.; Wholesale Electrical Co. (1922), Ltd.
Incandescent electric lamps.—General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.; British Thomson-Houston Co., Ltd.; Siemens and English Electric Lamp Co., Ltd.; Metro-Vick Supplies, Ltd.
Motors, starters, fans, and spares.—Berkeley & Young, Ltd.
Resistance units.—Zenith Mfg. Co., Ltd.
Resistances.—Bertram Thomas.
Telephone receivers.—S. G. Brown, Ltd.
Telephone spares.—A. Graham & Co.
W.t. fittings.—Bulpitt & Sons, Ltd.; Sir Jas. Laing & Sons, Ltd.; W. McGeoch & Co., Ltd.; Player & Mitchell; Park Royal Engineering Co., Ltd.; Veritys, Ltd.:

WAR OFFICE.

Electrical fittings (porcelain).—Metro-Vick Supplies, Ltd.

AIR MINISTRY.

Alternators and switch panels.—(Watford, Hawkinge, and Sarafand): English Electric Co., Ltd.
Ammeters and voltmeters.—Evershed & Vignoles, Ltd.
Battery boosters.—Pritchett & Gold & E.P.S. Co., Ltd.; D.P. Battery Co., Ltd.
Overhead cranes.—H. Morris, Ltd.
Generators and a.c. motors.—(Netheravon): Electric Construction Co., Ltd.
Internal wiring of buildings.—(Tangmere): Malcolm & Allan, Ltd.
Underground mains.—(Netheravon): G. E. Taylor & Co., Ltd.
Watt-hour meters.—General Electric Co., Ltd.
Wiring of buildings.—(Willering): Cox, Walker & Partners.
Dynamometer.—Laurence Scott & Co., Ltd.
Installation of lights at Croydon Aerodrome.—Neon Lights (1923), Ltd.
Magnetos and spares.—British Thomson-Houston Co., Ltd.
Modified t.f. receivers.—British Thomson-Houston Co., Ltd.
Sparking plugs.—Robinhood Engineering Works, Ltd.
Transmitters and controls.—Gambrell & Sons, Ltd.
Valves.—General Electric Co., Ltd.

POST OFFICE.

Telephone apparatus.—British Insulated & Helsby Cables, Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; A. C. Cossor, Ltd.; General Electric Co., Ltd.; Muirhead & Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Radio, Phonopore & Electricals, Ltd.; Siemens Bros. and Co., Ltd.; Sterling Telephone & Electric Co., Ltd.; Telegraph Condenser Co., Ltd.; T. Watson; Western Electric Co., Ltd.
Testing and protective apparatus.—Phœnix Telephone & Electric Works, Ltd.; Power Equipment Co., Ltd.; H. W. Sullivan, Ltd.
Battery stores.—Chloride Electrical Storage Co., Ltd.; Fuller's United Electric Works, Ltd.; Oldham & Sons, Ltd.; Pritchett & Gold and E.P.S. Co., Ltd.; C. A. Vandervell & Co., Ltd.;
Cable bearers.—Bullers, Ltd.
Telephone cabinets.—Siemens Bros. & Co., Ltd.
Cable (various).—British Insulated & Helsby Cables, Ltd.; Connolli's (Blackley), Ltd.; Enfield Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Steel capping.—R. A. Skelton & Co. (W. Wesson & Co., Ltd.).
Loading coils.—Western Electric Co., Ltd.
Ducts.—G. Jennings; Donington Sanitary Pipe & Fire Brick Co., Ltd.; Doulton & Co., Ltd.
Motors for stamping machines.—M. W. Woods, Ltd.
Wallboards.—H. Brown & Sons.
Manufacture, supply, drawing-in and jointing cable (Taunton repeater station, Taunton P.O.): Siemens Bros. & Co., Ltd. Wimbledon-Malden Junction: W. T. Henley's Telegraph Works Co., Ltd.
Telephone exchange equipment.—Coventry: General Electric Co., Ltd.; sub-contractors: Chloride Electric Storage Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Rossendale: General Electric Co., Ltd. Barnsley: General Electric Co., Ltd. Murrayfield (Edinburgh): Siemens Bros. & Co., Ltd. Morningside (Edinburgh): Siemens Bros. & Co., Ltd. Newington (Edinburgh): Siemens Bros. and Co., Ltd; sub-contractors: Hart Accumulator Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines; Crompton and Co., Ltd., for ringing machines. Stockport: Siemens Bros. & Co., Ltd. Camberley: Siemens Bros. & Co., Ltd. Gravesend: British L. M. Ericsson Mfg. Co., Ltd. Bedford: Western Electric Co., Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries; Newton Bros. (Derby), Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines. Slough: Western Electric Co., Ltd. Ravensbourne: Western Electric Co., Ltd. Upton (Liverpool): Automatic Telephone Mfg. Co., Ltd. London Wall: Automatic Telephone Mfg. Co., Ltd.
Private branch exchange installations.—Shell-Mex, Ltd. (Ipswich) and Lang's Bread Co., Ltd. (Glasgow): Relay Automatic Telephone Co., Ltd.

H.M. OFFICE OF WORKS.

Wiring Patent Office.—A. Dean & Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Electric head lights for locomotives.—Baldwin Locomotive Works.
Electric light fittings, &c.—J. Stone & Co.; Chloride Electrical Storage Co., Ltd.
Magnetic instruments.—Cambridge Instrument Co., Ltd.
Switchboard cable.—Siemens Bros. & Co., Ltd.
Switchboard jacks.—Western Electric Co., Ltd.
Telephone cable.—British Insulated & Helsby Cables, Ltd.; Pirelli-General Cable Works, Ltd.
Telephone materials.—British L. M. Ericsson Mfg. Co., Ltd.
Turbo-generator plant.—Sir W. G. Armstrong, Whitworth & Co., Ltd.
Wireless apparatus.—Radio Communication Co., Ltd.; Marconi's Wireless Telegraph Co., Ltd.

Portsmouth.—The Electricity Committee reports that, when inviting tenders for turbine and condensing plant, quotations were obtained for an 8,000-kW set as well as for the 6,000-kW set. The following is a list of the tenders received for the complete plants:—

	6,000-kW set.	8,000-kW set.
	£	£
English Electric Co., Ltd.	24,050	29,540
Brush Electrical Engineering Co., Ltd. ...	24,340	—
Met.-Vickers Electrical Co., Ltd.	26,930	32,800
British Thomson-Houston Co., Ltd.	24,003	29,344
James Howden, Ltd.	24,260	30,072
Daniel Adamson, Ltd. ...	23,550	28,878
Peter Brotherhood, Ltd. ...	24,729	29,445
Richardsons, Westgarth, Ltd.	23,024	28,648
Fraser and Chalmers Eng. Works (Recommended)	**23,873**	**29,210**
C. A. Parsons, Ltd.	23,750	28,920
Belliss & Morcom, Ltd.	23,571	28,790
Brown, Boveri, Ltd.	17,905	21 851
Escher, Wyss, Ltd.	17,102	24,193

Recommended:—
Boiler plant for generating station extension (£16,565).—Babcock and Wilcox, Ltd.
Cable (£1,185).—Johnson & Phillips, Ltd.
Switchgear for testing Grove & Cosham sub-stations (£1,068).—English Electric Co., Ltd.
Switchgear for main switchboard extension (£774).—English Electric Co., Ltd.

London. — ISLINGTON.—Electricity Committee. Recommended:—

Overhauling the electric battery (£407).—Tudor Accumulator Co., Ltd.

HACKNEY.—Electricity Committee.

Sub-station converting plant:—

Four 1,000-kW converters (£13,772).—Bruce Peebles & Co., Ltd. (Recommended.)

SHOREDITCH.—Lighting Committee. Recommended:—

Cables (£2,700).—W. T. Glover & Co., Ltd.

600-kW automatic converting equipment (£1,305).—Hewittic Electric Co., Ltd.

BATTERSEA.—Electricity Committee. Recommended:—

Cables for the year.—Callender's Cable & Construction Co., Ltd.

Electricity meters for the year.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.

Libraries Committee. Recommended:—

Heating panels for new reference library (£140).—Morgan Crucible Co., Ltd.

LAMP CONTRACTS.—Metro-Vick Supplies, Ltd., has received a contract for the supply of "Cosmos" lamps to the London Electric Railway, also part contracts for supplies of electric lamps to the Admiralty and the British Empire Exhibition, Wembley, and for the supply of electric lighting accessories and bell material for six months to the St. Mary, Islington, Board of Guardians.

Wolverhampton.—Electricity Committee. Recommended:

New turbo set.—British Thomson-Houston Co., Ltd.

Condensing plant.—W. H. Allen, Sons & Co.

Forthcoming Events.

Institution of Electrical Engineers (North-Eastern Centre).—Monday, April 27th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Annual general meeting.

(North-Midland Centre).—Tuesday, April 28th. At the Hotel Metropole, Leeds. At 6.45 p.m. Annual general meeting and smoking concert.

(South-Midland Centre).—Wednesday, April 29th. At the University, Birmingham. At 7 p.m. Annual general meeting.

Faraday Society.—Monday, April 27th. At Burlington House, W.1. At 8 p.m. Ordinary meeting.

Junior Institution of Engineers.—Friday, May 1st. At 39, Victoria Street. At 7.30 p.m. Lecturette on "Pumps and Pumping," by Mr. A. A. Fairfax.

Faraday House Old Students' Association.—Friday, May 1st. At the Hotel Cecil. At 8 p.m. Annual smoking concert.

Notes.

Specification for Bus-Bars and Connections.—A new British standard specification for bus-bars and connections (No. 159-1925) has just been issued. Early last year the British Engineering Standards Association issued a specification for the marking of switchboard bus-bars and connections (No. 153-1924), and the new specification just issued refers to the quality of metal, limits of temperature rise and current density, and joints between conductors; it also includes recommended sizes of flat and round bars both for copper and aluminium. Copies are obtainable from the B.E.S.A., Publications Department, 28, Victoria Street, London, S.W.1, price 1s. 2d. post free.

Memorial to the Royal Naval Division.—To-morrow (April 25th) the memorial to the members of the Royal Naval Division who gave their lives in the war will be unveiled, at 3.30 p.m. It takes the form of a fountain designed by Sir Edwin Lutyens, and is situated near the Admiralty Buildings on the Horse Guards Parade, Westminster.

The London Electrical Engineers.—The following is the programme of work for next month of the 27th A.A. Battalion R.E. (T.A.) (London Electrical Engineers) at 46, Regency Street, Westminster, S.W.1:—

304th Company (Major W. H. Merrett, T.D., A.M.I.E.E.). Mondays, 7 p.m. to 9.30 p.m. H.q. and Royal School of Mines.

305th Company (Major A. W. M. Mawby, O.B.E., A.M.I.E.E.). Tuesdays, 7 p.m. to 9.30 p.m. H.q. and one mobile station.

306th Company (Major F. C. Clarke, A.M.I.E.E.). Fridays, 7 p.m. to 9.30 p.m. H.q. and Royal School of Mines and one mobile station. Searchlight and sound-locator practices. Petrol-electric lorry-driving classes.

The Battalion mans 12 searchlights at the British Empire Exhibition, commencing the first week in May.

The Requirements of Rural Electrification.—In concluding an article describing the use of electricity on an American farm, the *Electrical World* says that before rural electrification can be instituted successfully much research work must be done in the following directions:—Determining a satisfactory rate; improving existing farm machinery, involving re-designing, reconstruction, and to a great extent making the machinery automatic; determining the ratings and sizes of farm machinery best for use; ascertaining the proper farming methods for ensuring the most uniform use of labour and machinery; and educating all parties interested in rural development.

Legal.—LICENCE NEEDED FOR DRIVING AN ELECTRIC "SCOOTER."—Ernest Shelton, Holly Lane, was summoned at Smethwick Police Court on April 15th for driving an electric "scooter" without a licence in New Street, Birmingham. It was stated that the scooter was used at a local works between one department and another. Defendant told the magistrates that the man who usually drove it was taken ill, and the foreman told him to drive it. He did not know that a licence was necessary. The magistrates said it was an unusual case, and in the circumstances they discharged defendant on the payment of costs.

The Women's Electrical Association.—Members of the Women's Electrical Association have received an invitation to the E.L.M.A. Lighting Service Bureau, for April 30th, at 6.15 p.m., when Mr. W. E. Bush will give a short talk on "Modern Lighting Methods," and an exhibition of appliances representative of good and bad lighting practices will be held.

Diesel-Electric Locomotives.—The use of Diesel-electric motor coaches for railway working is being developed in Sweden, and some 25 coaches of this type, of from 60 h.p. to 300 h.p., are said to be at work in that country, Denmark, France, and Tunis. The type employed has been worked out through the co-operation of the Allmänna Svenska Elektriska A.B. of Västeras and the A.B. Diesels Motoren of Stockholm, which formed the Diesel-Elektriska Vagn A.B. (Deva) in 1919 to develop the use of this type of coach, which is now known as the "Deva" motor coach. The 25 coaches in service are stated to have covered a distance of 3,100,000 miles, the first having been introduced on the Central Sodermanlands railway in 1913. It is claimed that the coaches have been found by experience to be as fully reliable in working as steam locomotives, and the cost of working is less than one-half of that of the latter; crude oil is used, and the cost of maintenance is said to be less than in the case of steam locomotives. The equipment of a "Deva" coach consists of a high-speed Diesel engine with electrical transmission to the driving wheels. It is stated that the exploiting company now has on hand orders for 10 further motor coaches for various Swedish railways, some of these representing repeat orders.

Powdered Coal in Germany.—What are claimed to be the largest boilers using powdered coal have recently been installed in a German electric power station. They have a total heating surface of 2,770 sq. metres each, work at a pressure of 20 atmospheres, and are built on the Humboldt principle, the upper boilers lying across the lower ones, *i.e.*, in the longitudinal direction of the water circulation. A special feature of the installation is its height; for the space occupied, double the quantity of steam is produced, compared with the ordinary arrangement. The powdered-coal grate apparatus, which has already been at work for four years, has been built into new boilers, and the flame is blown down against a travelling-grate charged with solid fuel. The travelling-grate thus need only be half as large as it would otherwise be.

Tunbridge Wells Extensions.—The new extensions to the Tunbridge Wells Electricity Works, described in our columns on April 17th, were opened officially by the Mayor, Councillor S. Parsonage, on April 16th. Colonel Spender-Clay, M.P., and many aldermen, councillors, officials, and visitors were present. The extensions and work in connection with the conversion of the supply to three-phase, 50 cycles were inspected with great interest. A luncheon at the Wellington Hotel followed the ceremony, Councillor S. Dennis, chairman of the Electricity Committee, presiding. Colonel Spender-Clay, in proposing "The Borough of Royal Tunbridge Wells," said that they had seen an example of the enterprise of the borough. The Mayor, in reply, said he believed that in a few years the undertaking would be one of the most important in the Southern Counties. Mr. E. Lacey, in proposing "The Undertaking," congratulated the Committee on changing the system of supply to one of modern practice, and also on the manner in which the extensions had been carried out. The Chairman, in reply, said that the Committee was proud to be associated with that successful undertaking. The Corporation had a completely new generating station, which was giving supplies to surrounding districts and would shortly supply Tonbridge. The price of electricity would compare favourably with any other town in the South of England. He paid a special tribute to Mr. R. N. Torpy, M.I.E.E., borough electrical engineer, and the staff at the electricity works. Mr. Torpy said he had no doubt that the new plant would do well, and he anticipated a further reduction in the price of electricity in the future. He was grateful for the work of the contractors and also to Mr. Pownell, Mr. Mackean, and the staff.

Overhead Line Inspection by Aeroplane.—According to the *Electrical World*, a specially designed light aeroplane has been made in Germany for use in the inspection of long-distance overhead transmission lines where the right-of-way is inaccessible by car. The aeroplane has a cruising radius of 250 miles. The 50 h.p. engine gives the craft a speed of 77 m.p.h., which is not too fast to permit inspection of the line when flying about 50 yards above it. The machine has a wing-spread of only 30 ft., and is so designed that both pilot and observer have a free view downward. It consumes 30 lb. of petrol and 3 lb. of oil per hour. The landing gear is so designed as to permit safe landing in out-of-the-way places.

The Muscle Shoals Development.—The President of the United States has nominated a Commission to "examine into and report to him upon the most practical method or methods of utilising to the best advantage the Muscle Shoals facilities." Mr. W. McLellan, a former president of the American Institute of Electrical Engineers, is a member of the Commission. The other members are interested principally from the point of view of fertiliser production.

Electrical Cleaning of Gases.—An interesting modification of the usual method of cleaning gases by electrical precipitation is outlined in German patent No. 394,577 (Gelsenkirchener Bergwerks, Gelsenkirchener, A.G.). The gas containing drops of water or solid particles is irradiated with light at such a wavelength as to bring about on the surface of such drops or motes a lumino-electric effect and give them a positive charge. Simultaneously the so-treated gas is led through a strong electrical field which precipitates the impurities. The irradiation of the gas may be effected by using the ordinary arc, mercury-vapour lamp, or electric spark.

Paris Suburban Electrification.—Some interesting details concerning the electrification of the Paris suburban railways are given in the *Railway Gazette*. The State electric railways from St. Lazare, Invalides, and Montparnasse stations are being extended. The electrification from Reseil to St. Germain and to St. Claud will be carried out this year, and the complete electrification of the Versailles lines to Issy, St. Nom-la-Bretiche, and Argeateuil is scheduled for 1927.

Electrification has greatly increased the capacity of the St. Lazare station. Under steam operation 16 of the 27 tracks were required for short-haul suburban service, while only 11 tracks are required with electrical operation, and the capacity is increased to 44 trains an hour. The power is generated at two stations, Bezons in the north and Moulineaux in the south. Both are equipped with 5,000-kW, 15,000-V, three-phase, 25-cycle turbo-alternators. The energy is supplied at 650 V through a protected third rail, but it can be used at 1,500 V d.c. if desired. In April, 1922, 30 multiple-unit control locomotives were ordered from a group formed by the Thomson-Houston, Schneider, and Jeumont interests. They are 39.3 ft. long, have truck centres at 20 ft., weigh 60 metric tons, and have an output of 1,100 h.p., with four motors at 750 V. The normal speed on level track is 39 m.p.h., with a shunt connection to permit 43.8 m.p.h. The trains are made up of one, two, or three pairs of cars, comprising one motor and one trailer of the multi-side-door type. The two trucks of the motor-car carry four 165-h.p. motors; the car weighs 57 tons and will carry 72 persons. Each trailer weighs 37.5 tons. The new cars have been in operation since May, 1924, and have given perfect satisfaction.

Educational.—Technical Schools.—The Board of Education has issued through the Stationery Office a list (4s. net) of technical schools and schools of art in England and Wales recognised by it under the Regulations for Technical Schools, &c. (List 111). The object of the publication is to supply information about the more important institutions, their postal address, and a brief indication of the courses or branches of study followed.

Electricity and the Welfare of the People.—In a recent speech on the above subject at St. Paul's Church, London, Alderman Herbert Morrison, L.C.C., said that electricity was a subject which related very materially to the welfare of the people. It was the duty of all, and especially those interested in social subjects, to turn their minds in the direction of means by which the working day and the working conditions of the woman in the home could be ameliorated. Electric lighting could be well done or badly done. The modern electrician was devoting his time to the better distribution of light by reflection whereby he got a pleasant light all over the room with no glare. Gas lighting threw fumes about the room, which caused dirt to collect on the ceiling. These fumes in the home were detrimental to health, and also increased the maintenance costs of the house. In the gas cooker it was necessary to have a constant supply of cool air going into the apparatus, and in consequence the flame had to continually heat the new air which was coming in. Also in the practical use of gas, one often left it on sometimes for five or ten minutes, and this meant considerable unnecessary expense. With electricity one had a switch, and with this facility of control, one used less energy than one would have done with gas. The comparison of the thermal unit was misleading and was really beside the point. He said it was of vital importance that the generation of electricity should not be carried on by separate undertakings as at present, but it should be under one central control for Greater London, which would materially help the diversity factor.

Report on Colliery Explosion.—A report on the investigations by H.M. Chief Inspector of Mines into the causes of and circumstances attending the explosion which occurred at the Hartley Bank Colliery, Netherton, Yorkshire, on May 23rd, 1924, has been issued by the Mines Department, and can be purchased from H.M. Stationery Office, price 6d. net. The explosion, in which four persons lost their lives and two others were injured, is attributed to the ignition of firedamp by some of it gaining access to the interior of a reversing switch of a coal-cutting machine through a hole in a switch case left by the omission of a set screw, the firedamp in the switch becoming ignited and flame escaping through the set screw hole and igniting firedamp external to the switch. All possible avenues leading to the probable cause of the explosion were explored, and finally the reversing switch box was sent to Mr. O. B. Patt, the superintending testing officer, to determine: (*a*) To what extent firedamp would diffuse into the switch casing when the latter was placed in an atmosphere containing firedamp; and (*b*) whether an ignition of firedamp within the switch casing would cause an ignition of an explosive atmosphere external to the casing. The tests were made with one of the set screws used to attach the plug box to the reversing switch box not in place, the condition in which it was found after the accident, and showed that (*a*) firedamp could diffuse into the switch box in a comparatively short time, and that (*b*) an ignition of firedamp within the switch casing could undoubtedly cause an ignition of firedamp and air in a mine even though in (*a*) and (*b*) the hole in the switch casing were covered with cuttings made by the coal cutter when at work, as it may have been covered at the time of the explosion.

In the concluding remarks of the report it is said that since January 1st, 1914, there have been in use an average of 1,949 electrically-driven coal-cutting machines each year, and 19 explosions of firedamp due to the use of these machines have been reported; of these explosions many, if not all, were preventable. Attention is called to steps which it is considered should be taken to prevent accidents of this character. Attention is also called to the discrepancy between Section 60 (2) of the Coal Mines Act, 1911, and General Regulation 132 (v) made under that Act. By the former it is required that "all electric current shall be cut off if the percentage of inflammable gas exceeds one and a quarter," and by the latter, "should any indication of firedamp appear, the person appointed to work the motor shall forthwith cut off all the pressure therefrom." The discrepancy is more apparent than real—with ordinary safety lamps an indication of firedamp would be as near 1¼ per cent. as makes no practical difference.

The World's Water Power.—The potential water power of the world is estimated at 453,000,000 h.p. by the United States Geological Survey in a review recently issued. The developed water power at the end of 1923 is placed at about 29,000,000 h.p., according to the best information available; this represents an increase of 26 per cent. in the three years following 1920. Europe, as a whole, has beaten the United States in the rate of development of water power, such development having been forced on all European countries except Great Britain by the high price of coal. In Europe, the review states, France leads in developed water power, with 2,100,000 h.p., while Norway has the largest potential water power with 9,500,000 h.p. The British Isles are credited with 250,000 h.p. developed and 850,000 h.p. potential. Japan has the largest developed water power in Asia, with 1,694,000 h.p., while the potential power is placed at 4,500,000 h.p. India, with 27,000,000 h.p., has the largest potential power in Asia, while China is second with 20,000,000 h.p. Africa leads all continents in potential water power with a total of 190,000,000 h.p., the Belgian Congo and Belgian Mandated Territory coming first with 90,000,000 h.p. The Union of South Africa is credited with 5,000 h.p. developed, and 1,600,000 h.p. potential. —*Reuter's Trade Service* (Washington).

Birds and Flash-overs.—In an article by Mr. G. H. Stockbridge in the *Electrical World*, an interesting account is given of investigations which led to the discovery that flashovers, which had been occurring on the Big Creek overhead 220-kV lines of the Southern California Edison Company at the rate of one to two a month, were the result of hawks roosting over the line insulators, their droppings over the insulator surfaces causing the breakdown. Eagles were at first suspected, and precautions were taken to prevent them perching on the transmission towers over the lines; but the flashovers continued and observations directed attention to the habits of the hawks. It was thought that by tightly stringing ¼ in. galvanised cable parallel to and 4 in. above the horizontal tower members the hawks would be unable to find a satisfactory roosting place and flashovers would be reduced. This had the opposite effect and the flashovers increased enormously. Further investigation showed that the birds were now roosting on the shield rings round the tops of the insulators, and whereas it had previously been the exception to find bird droppings on the insulators, now the insulator strings were soiled from top to bottom. It seemed impossible for a bird roosting at the top of an insulator string and under a cross arm of the tower to cause a flashover and escape alive, but it was indisputable that they were doing so. But it was discovered that the flashovers do not always start with a rush of current but gradually build up in intensity until a short circuit develops.

The top rings were removed and the flashovers fell back to two a month, and it was then found that the birds were still roosting on the tower members in spite of the cable and other guards. A galvanised pan was then used on each tower of one section, extending out 4 ft. each side of the conductor support and no flashovers have occurred since on this section.

It was thought that the discomfort and inconvenience of roosting on the guard wires would ultimately discourage the birds from trying to roost in the centre of the tower. This apparently happened to some extent as the flashovers dropped below one a month, most of these occurring on outside conductors and dead-end towers, which were not properly protected. In all cases of dead-end flashovers the initial arc jumped from the bottom of the jumper loop to the cross-arm, and in several cases 3 ft. to windward, making a jump through the air of 7 ft. A new type of guard of a saw-tooth shape has now been devised which will, it is believed, be 100 per cent. bird proof.

Appointments Vacant.—Commercial secretary (£500), for the Wolverhampton Corporation Electrical Engineering Department; charge engineer for the Portsmouth Electricity Supply Department; draughtsman (£258) for the Royal Aircraft Establishment, South Farnborough; station superintendent for the Weymouth Corporation Electricity Department; mains assistant for the Wolverhampton Corporation Electricity Department; charge engineer for Sunderland Corporation Electricity Works; district engineer (£630) for the Municipal Commissioners of Singapore; engineer-in-charge for the Hammersmith Borough Council Electricity Works. (See our advertisement pages to-day.)

Royal Air Force Display.—The Royal Air Force Pageant which was instituted in 1920 has now been re-named the Royal Air Force Display. It will take place on Saturday, June 27th, at the London Aerodrome, Hendon. A programme has been arranged which will fully equal that submitted in previous years, and new features are being introduced which will enable the public to appreciate the developments that are constantly taking place in the aerial arm. As in the case of the Royal Tournament, all the proceeds are devoted to Service charities.

The Adventure of "R 33."—In view of the exciting break-away of the airship R 33 and her safe return, guided by directional wireless telegraphy, we learn with interest that the batteries upon which the operation of her wireless equipment depended were of the "Exide" make.

Institution Notes.

Institution of Electrical Engineers.—SUMMER MEETING.—As has already been announced, the summer meeting of the Institution will be held this year at Birmingham, from June 9th to 12th. As 300 members and their ladies have already sent in their names, others wishing to take part are advised to send their applications without delay to the secretary.

Institute of Transport. — The fifth congress of the Institute of Transport will be held in London from May 12th to 16th. The programme will include the annual dinner at the Hotel Cecil, on May 13th; the reading and discussion of papers at the Institution of Electrical Engineers, among which is one by H. J. Deane on "Modern Dock Equipment," to be read on May 15th; and also a number of works visits, &c., including railway constructional works and docks.

Diesel Engine Users' Association.—At the well-attended April meeting Mr. J. L. Chaloner read a paper on "Recent Oil Engine Developments," with the exhibits at the Wembley Exhibition last year as a basis. The popularity of the oil engine for stationary power generation was indicated by the large number of firms concentrating on the manufacture of various sizes up to 1,500 b.h.p., although this power was by no means the limit of the modern large-sized unit. Continental types of 4,000 b.h.p. in six cylinders were actually in commission. In these days of intensive competition from hot-bulb and cold-starting engines, the stationary engine of the Diesel type had found its further development in the direction of larger outputs and standardisation of parts.

Institute of Physics.—The eighth of the public lectures on "Physics in Industry" that are being delivered under the auspices of the Institute of Physics will deal with "Physics in the Rubber Industry, with Special Reference to Tire Manufacture." The lecture will be given by Dr. W. Makower, at Burlington House, London, on April 29th, at 5.30 p.m.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Hackney Borough Council Electricity Committee recommends that Mr. W. B. BARHAM, constructional engineer, be transferred from Grade 5 to Grade 4 of the E.P.E.A. schedule, at a salary of £562 per annum. The Establishment and General Purposes Committee concurs in the recommendation.

The *British Chamber of Commerce Journal*, Shanghai, states that Mr. L. C. SMITH, of the General Electric Co. of China, Ltd., has been transferred to Dairen, and that Mr. S. FLEMONS, of the Shanghai Mutual Telephone Co., Ltd., left for home on leave on March 6th.

East Ham Town Council has appointed Mr. W. R. ELLIOTT, manager of the electricity undertaking, as engineer and manager of the tramways.

Mr. E. COOK, A.M.I.E.E., of the Electricity Department of the Wallasey Corporation, has been appointed deputy borough electrical engineer and manager.

Mr. T. W. WICKHAM, assistant traffic superintendent of telephones for the Southampton district, who has been appointed traffic superintendent at Newcastle-on-Tyne, has been presented, on his departure, by the staff with a suit case and a silver cake stand.

St. Pancras Electricity and Public Lighting Committee recommends that Mr. W. A. BROWN, meter superintendent and inspector of installations, be transferred from Grade 8a to Grade 7 of the E.P.E.A. schedule, at a salary of £407 per annum.

Mr. A. W. MAKOVSKI, of Messrs. Tamplin & Makovski, Ltd., electrical engineers, of Reigate, and Charing Cross Road, W.C., has been re-elected president of the Reigate and Redhill Chamber of Commerce.

Mr. H. G. W. HASLETT has resigned his position with Messrs. L. G. Hawkins & Co., Ltd., in order to take charge of the heating and cooking department of Messrs. Baxter and Caunter, Ltd., who are the London agents for the Credenda Conduits Co., Ltd. Mr. F. G. NESBITT has been transferred from Messrs. Baxter & Caunter, Ltd., to Credenda Conduits Co., Ltd., having been appointed manager of the heating and cooking department of that concern.

The *Australian Electrical Times* states that Mr. G. L. JUST, who has been for about 20 years manager of the Edison Swan Electric Co.'s business in Victoria, has been appointed general manager for Australia. Mr. S. ROLLS is now acting-manager for the company in Victoria. Mr. C. F. SHARPE has transferred to Sydney, and is acting-manager of the N.S.W. business.

Owing to advancing years, Mr. GEORGE CHAUVIN has resigned the position of managing director of Messrs. Siemens Bros. and Co., Ltd., which he has held since April, 1899, during which time the works and manufacturing activities of the company have been very largely expanded. The company, however, will continue to have the benefit of his experience and advice, as he will retain his seat on the board as a director. Mr. FRANCIS HIRD, B.A., M.I.E.E., who has been appointed to succeed him as managing director, has assisted Mr. Chauvin for many years in the management of the company, and for the past three years has held the post of general manager.

Obituary.—MR. GODFREY ISAACS.—In November last, when Mr. Godfrey Isaacs resigned the office of managing director of Marconi's Wireless Telegraph Co., Ltd., it was obvious that he was a tired man worn out by overwork. He joined that company at the invitation of Senator Marconi in 1910, and for 14 years he brought to bear upon its affairs, which grew to such large proportions and comprised interests in all parts of the world, a remarkable energy, business acumen, financial skill, and organising ability. It is said that broadcasting was "the last straw." In the Press he is credited with regrets that he had sacrificed himself to business activities. Hopes were entertained that he would gradually win his way back to health, but on April 13th he was compelled to take to his bed, and on the 17th inst. he passed away in his 59th year. The reader of these pages does not need to be told that during the 14 years of his control of the Marconi Co. the developments of wireless telegraphy and telephony in all aspects have been both rapid and continuous. In 1912 there began those discussions in the political world regarding shares which formed so unhappy an episode; negotiations extended over many years with Government departments here and in many other countries; the British Empire wireless chain controversy was constantly forward; there were cases in the Law Courts, and all the time the ordinary business activities of the company were developing; indeed, these activities alone were enough to well-nigh overwhelm the most capable human mind. Then came broadcasting and all that it meant by way of added burden. Not long ago he recognised that he had made the mistake of pursuing work to the exclusion of everything else, and the physical and mental strain broke him down completely; Mr. Kellaway then took the helm as managing director. Mr. Isaacs continued to hold a seat on the board of the Marconi Co. He was connected with many other companies, including the Sterling Telephone & Electric Co., Ltd., of which he was formerly chairman. He had limitless confidence and faith in the brilliant future of wireless communication.

The funeral took place at Chertsey Cemetery on Monday.

SIR DAVID SALOMONS.—We regret to learn, as we go to press, of the death, which occurred on Sunday, after an operation, of Sir David Lionel Goldsmid-Stern-Salomons. Sir David, who was 73 years of age, was formerly very prominently connected with electrical affairs. In the early 'seventies of last century he was interesting himself practically in incandescent electric lighting and later in electric vehicles. He was for some time chairman of the City of London Electric Lighting Company. He was for some years treasurer, vice-president and member of the Council of the Institution of Electrical Engineers, and he generously contributed a Fund for the establishment of the Sir David Salomons Scholarship. He was also an Associate of the Institution of Civil Engineers and was connected with various other scientific societies. He was the author of a number of papers on electrical and other scientific subjects and among the books written by him was one on "Electric Light Installations and the Management of Accumulators." He produced many electrical and other inventions and was an assiduous worker in the well-equipped laboratory at his house at Tunbridge Wells. In recent years his association with electrical matters had been less active than formerly, but right up to the last he was the President of the Electrical Trades Benevolent Institution.

New Companies Registered.

C.A.C. (Radio), Ltd. (205,291).—Private company. Registered April 16th. Capital, £20,000 in 10,000 10 per cent. preference and 10,000 ordinary shares of £1 each. Objects:—To carry on the business of electrical and motor engineers and contractors, suppliers of electricity, carriers of passengers, manufacturers, importers and exporters of and wholesale and retail dealers in railway and tramway appliances and requirements, telegraphic, telephonic and wireless apparatus and requirements of all kinds, &c. The subscribers are:—G. E. Ward, 10, Rangoon Street, Crutched Friars, E.C.3, merchant; Evelyn G. Brett, 16, Woburn Buildings, Woburn Place, W.C.2, secretary. G. E. Ward is permanent managing director. Qualification of directors, £250 shares. Remuneration, £150 each per annum. Solicitors: Montague White & Co., 61-62, Chancery Lane, W.C.2. Registered office: 10, Rangoon Street, Crutched Friars, E.C.3.

Elliott Radio Manufacturing Co., Ltd. (205,293).—Private company. Registered April 16th. Capital, £500 in £1 shares. Objects: To carry on the business of radio engineers and wireless assemblers, manufacturers of and dealers in hardware and ironmongery, &c. The permanent directors are:—G. J. Elliott, 87, Senhouse Street, Maryport, Cumberland, pharmacist; I. Elliott, 87, Senhouse Street, Maryport, Cumberland, radio engineer. Qualification, £5. Remuneration as fixed by the company. Solicitors: Paisley, Falcon, Skerry and Highet, Workington.

Ego Engineering Co., Ltd. (205,228).—Private company. Registered April 11th. Capital, £500 in 1s. shares. Objects: To carry on the business of manufacturers, builders, designers, repairers, and owners of and dealers in electrical and engineering machinery, engineers, machinists, smiths, electricians, &c. The directors are:—T. H. Joyce, 85, Ladbroke Grove, W.11, merchant (director, Contact Engineering Co., Ltd.); N. C. McAliece, 113, Gipsy Hill, S.E.19, merchant; Annie A. Joyce, 85, Ladbroke Grove, W.11. T. H. Joyce is permanent. Solicitor: W. Gowing, 4, Sackville Street, W. Registered office: 230, Shaftesbury Avenue, W.C.2.

Hart & Company (Edinburgh), Ltd. (13,620).—Private company. Registered in Edinburgh April 10th. Capital, £2,500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, motor car and cycle manufacturers, agents, dealers, &c. The subscribers (each with one share) are: J. G. A. Hart, 4, Ashley Place, Bonnington, Edinburgh, electrical and mechanical engineer; J. H. McLean, 2, Northfield Road, Piershill, Edinburgh, engineer. The first directors are not named. Qualification, 50 shares. Solicitor: W. S. Storie, 5a, York Place, Edinburgh. Registered office: 3, Ashley Place, Bonnington, Edinburgh.

Precision-Electric, Ltd. (205,237).—Private company. Registered April 11th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers and manipulators of all kinds of metal goods and insulating materials, automobiles and automobile accessories, apparatus for propagation, reception, and use of electrical, magnetic and electro-magnetic vibrations and effects, &c. The directors are:—A. S. Cheetham, 3, Vernon Road, Edgbaston, Birmingham, consulting engineer (permanent chairman and managing director); Mrs. Gertrude Cheetham, 3, Vernon Road, Edgbaston, Birmingham. Qualification, 10 shares. Registered office: 3, Vernon Road, Edgbaston, Birmingham.

T. Slack, Ltd. (205,242).—Private company. Registered April 11th. Capital, £1,000 in £1 shares. Objects: To acquire the business of electrical engineers and retailers of wireless supplies now carried on by H. Wynn and D. Lord at 1,207 Ashton Old Road, Higher Openshaw, Manchester, as "T. Slack." The permanent directors are:—H. Wynn, 1,353, Ashton Old Road, Higher Openshaw, Manchester; D. Lord, 1,207, Ashton Old Road, Higher Openshaw, Manchester. Qualification, 100 shares. Remuneration as fixed by the company. Solicitors: G. Egerton Pollitt, 35, Cross Street, Manchester. Registered office: 1,207, Ashton Old Road, Higher Openshaw, Manchester.

Electric Cables, Ltd. (205,326).—Private company. Registered April 17th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of insulated wire and cable manufacturers, electricians, mechanical engineers, and manufacturers and workers of, and dealers in electricity, motive power and light, &c. The directors are:—E. J. Hogan, "Cotterbrook," New Barnet, Herts., engineer; F. Wardrop, 43, Coniston Road, Muswell Hill, N.10; H. J. van Aller, 26, Regge Straat, Utrecht, Holland. Qualification, 1 share. Remuneration as fixed by the company. Solicitors: Charles Nordon & Co., 56, Moorgate Street, E.C. Registered office: 88, Golden Lane, E.C.1.

Official Returns of Electrical Companies.

Star Lamp Co., Ltd. — Satisfaction in full on January 12th, 1925, of debenture dated October 15th, 1923, securing £400.

Orlings Telegraph Instruments Syndicate, Ltd.—Issue on April 1st, 1925, of £25 debentures, part of a series already registered.

Bucks Electric Wire and Engineering Co., Ltd.—Debenture dated March 24th, 1925, to secure £800 charged on the company's undertaing and property, present and future, including uncalled capital. Holder: A. Bullard, Tykeford Lodge, Newport Pagnell, Bucks.

Robins, Ltd.—Debenture dated April 3rd, 1925, to secure £550 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: R. W. Robins, "Walbrook," Cyn Coed Road, Cardiff.

Pulford Brothers, Ltd. — Mortgage dated March 17th, 1925, to secure £12,000 charged on certain property in Whitechapel, Liverpool. Holder: S. W. Bridgwater, 3, Wakefield Street, Liverpool.

Watford Radio Supplies, Ltd.—W. R. Faulkner, of 133, Lower Paddock Road, Watford, was appointed receiver on April 2nd, 1925, under powers contained in debenture dated June 19th, 1924.

Vactite Wire Co. (1919), Ltd. (156,012).—Return dated November 24th, 1924. Capital, £25,000 in £1 shares. 15,000 shares taken up. £3 paid. £14,997 considered as paid. Mortgages and charges, nil.

Whittaker Bros., Ltd. (67,858).—Return dated December 31st, 1924. Capital, £7,000 in 1,000 preference, 5,000 "A" ordinary, and 1,000 "B" ordinary shares of £1 each. 3,907 shares (class not stated) taken up. £3,207 paid. £700 considered as paid. Mortgages and charges, nil.

Brecknell, Munro & Rogers, Ltd. (79,766).—Return dated January 13th, 1925. Capital, £150,000 in 2,200 preference shares of £5 each and 278,000 ordinary shares of 10s. each. 2,058 preference and 174,829 ordinary shares taken up. 10s. per share called up on 160,767 ordinary shares and £5 per share on 2,058 preference shares. £90,673 10s. paid. £7,631 considered as paid on 14,062 ordinary shares. Mortgages and charges, nil.

Leamington and Warwick Electrical Co., Ltd. (13,780).—Return dated March 6th, 1925. Capital, £100,000 in 2,500 preference and 7,500 ordinary shares of £10 each. 1,100 preference and 6,900 ordinary shares taken up. £79,000 paid. Mortgages and charges, £35,000.

Cambridge Electric Supply Co., Ltd. (36,457).—Return dated March 25th, 1925. Capital, £100,000 in £10 shares. All shares taken up. £100,000 paid. Mortgages and charges, £75,000.

Fryer & Hartley, Ltd.—Deposit on April 7th, 1925, of deeds of leasehold land in Slack Street, Rochdale, with warehouse and other buildings thereon, to secure £200. Holder: R. Mills, "Edenside," Manchester Road, Rochdale.

Edward Wilcox & Co., Ltd.—Particulars filed on April 4th, 1925, of £500 debentures authorised December 18th, 1924, charged on the company's property, present and future, including machines, tools, patents, and stock-in-trade, the whole amount being now issued.

Robert W. Blackwell & Co., Ltd. (63,446).—Return dated January 14th, 1925. Capital, £50,000 in £1 shares. All shares taken up. £18,338 paid. £31,662 considered as paid. Mortgages and charges, nil.

Westminster Electric Supply Corporation, Ltd. (27,061).—Return dated March 11th, 1925. Capital, £2,000,000 in 200,000 ordinary and 200,000 4½ per cent. preference shares of £5 each. 151,124 ordinary and 110,000 preference shares taken up. £1,305,620 paid. Mortgages and charges, nil.

City Notes.

Windermere and District Electricity Supply Co., Ltd.

The report which was presented at the company's meeting last month shows a balance of £6,725, to which was added £541 brought forward and £370 interest on debentures of the Keswick Electric Light Co. Of this, £250 was written off against free wiring; £1,500 was transferred to depreciation account; and £2,500 to reserve. Out of the balance a dividend of 6 per cent. was paid on the 6 per cent. cumulative preference shares (clearing arrears to July 31st, 1909), and £766 was carried forward. At a meeting to be held yesterday (Thursday) a proposal was to be put forward for the issue of 2,000 non-cumulative 7½ per cent. preference shares of £5 each to rank for dividend after 6 per cent. has been paid on the cumulative preference shares and before anything is paid off on account of arrears on those shares. The existing arrears are to be satisfied by a cash payment and the allotment of new shares.

Prospectuses.

Tottenham District Light, Heat and Power Co.—The directors have published a prospectus asking for tenders, up to May 1st, for £150,000 of 5½ per cent. irredeemable preference stock; the minimum price of issue is par. The company states that it supplies gas within an area of some 30 square miles of North London suburbs, and electricity in the Wood Green district. The output of electricity during 1924 was seventeen times greater than in 1915; the supply commenced in 1914.

Madras Electric Supply Corporation, Ltd.—During the current week the company issued a prospectus offering 250,000 5½ per cent., tax-free preference shares of £1 each, at 21s. per share. Preference was to be given to existing share and debenture holders. The proceeds are for the redemption of the outstanding first mortgage debentures and the provision of further working capital for the development of the undertaking.

Belgian Companies.

The *Société Belge pour la Fabrication des Fils et Câbles Electriques*, which owns almost all the capital in the Société des Câbles et Tubes du Nord, of Roubaix, France, reports net profits of 825,000 fr. for 1924, and the payment of a dividend at the rate of 38.95 fr. per share on the old capital.

The directors of the *Ateliers de Constructions Electriques de Charleroi* report gross profits of 10,011,000 fr. for 1924, as compared with 6,476,000 fr. in the previous year. After having written off 1,500,000 fr. for depreciation, as against 1,200,000 fr. in 1923, and having defrayed interest and other charges, the accounts show net profits of 5,295,000 fr., as against 5,303,000 fr. in 1923 on a share capital of 80,000,000 fr. It is proposed to pay a dividend at the rate of 6 per cent. as in the preceding year.

The *Compagnie d'Electricité des Ardennes* (Liége) is raising its capital from 1,500,000 fr. to 4,000,000 fr.

French Companies.

The *Société de Construction Electrique*, of Lyons, proposes to pay a dividend at the rate of 7 fr. per share out of net profits of 313,000 fr. in 1924.

The directors of the *Société Industrielle Electro-Chimiques Bozel-Lamotte* propose to pay a dividend at the rate of 22.50 fr. per share for 1924, as compared with 20 fr. in the previous year.

The *Société le Transformateur* records gross profits of 2,424,000 fr. and net profits of 940,000 fr. for 1924, most of which has been devoted to depreciation and a small balance carried forward.

The *Compagne Générale Française de Tramways* reports net profits of 3,799,000 fr. for 1924. It is proposed to pay a dividend of 27.50 fr. per share (5½ per cent.), this comparing with 25 fr. in 1923.

The *Société des Câbles et Tubes du Nord*, whose share capital is held largely by the Société Belge pour la Fabrication des Fils et Cables Electriques, reports profits of 462,000 fr. for 1924, permitting of the payment of a dividend at the rate of 10 per cent.

German Companies.

The *Dr. Paul Meyer Company*, of Berlin, reports a turnover of 3,800,000 marks in 1924, but it does not propose to make any distribution. Orders at better prices are now being received.

The *Electrical Undertakings Company*, of Berlin, recommends a dividend at the rate of 6 per cent. for 1924 on share capital of 40,010,000 marks, this comparing with 10 per cent. on 60,000,000 marks in 1913.

The report of the *Electroworks Company*, of Berlin, which is owned by the Reich, the shares being held for the latter by the United Industry Undertakings, states that after placing 5,250,000 marks to the reserve fund, the net profits amount to 4,450,000 marks, permitting of the payment of a dividend at the rate of 7 per cent. on the share capital of 60,000,000 marks. The undertaking produced 1,410 million kWh, which was partly sold for the purposes of chemical works and for electricity supply in Berlin and other distant localities. A 100,000-volt line was constructed to Brandenburg (Havel) and to Spandau, Berlin.

The *Concordia Electricity Co.*, of Dusseldorf, has declared a dividend at the rate of 5 per cent. for 1924 out of net profits of 228,000 marks.

The *Rheydt Cable Works Co.*, of Rheydt, has obtained the sanction of the shareholders to an increase in the capital from 5,000,000 to 7,500,000 marks for the purpose of providing additional working funds for new equipment, &c.

The *Mix and Genest Telephone and Telegraph Works Co.*, of Schoneberg, reporting on 1924, states that the turnover and stock of orders at the works were very satisfactory. An active development took place in the automatic telephone business; besides a large number of private installations, automatic telephone exchanges for seven German towns and one foreign administration were in course of execution. The production of insulating material has become a very promising branch. In general, the report states that the demand for the company's manufactures is large, but prices are depressed owing to the rising costs of production. The net profits for 1924 amounted to 607,000 marks, permitting of the payment of a dividend at the rate of 8 per cent.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Burndept Wireless.—285,000 7½ per cent. preferred ordinary shares of £1 each, 10s. paid, Nos. 1 to 285,000.

Canadian General Electric Co.—52,000 common shares of $50 each, fully paid; and 52,000 preference shares of $50 each, fully paid.

International Telephone and Telegraph Corporation.—$17,995,600 common stock in shares of $100 each; and $8,997,500 new common stock in shares of $100 each, issued at $83, fully paid.

The undermentioned securities have been ordered to be officially quoted:—

Barcelona Traction, Light and Power Co.—£2,800,000 consolidated 6½ per cent. prior lien bonds Nos. A1 to 600 (£1,000), B1 to 1,800 (£500), and C1 to 13,000 (£100).

Canadian General Electric Co.—52,000 shares of common stock of $50 each, and 52,000 shares of preference stock of $50 each.

North British Aluminium Co.—Scrip, fully and partly paid for £2,500,000 4½ per cent. guaranteed debenture stock, 1931-55.

Stanton Ironworks Co.—Scrip, fully and partly paid for £1,000,000 4½ per cent. guaranteed debenture stock, 1931-45.

Sudan Construction and Equipment Co.—Scrip, fully and partly paid, for £540,000 4½ per cent. guaranteed debenture stock, 1931-1945.

Telephone Manufacturing Co., Ltd.—The report for the nineteen-month period ended December 31st last, to which brief reference was made in our last issue, states that nothing is included in the accounts in respect of profits earned during the period by the installation companies operating abroad, owing to depreciated currency, but any possible loss on this account has been provided for in the contingency reserve of £28,000. Difficulties have been encountered by the company, and the position was to be fully explained by the chairman at the annual meeting on Tuesday last. Viscount Chetwynd (late chairman) and Sir Philip A. M. Nash resigned their positions as directors in July last. Mr. John McMahon and Mr. C. E. Walker, former directors, and Mr. W. S. Philcox, general manager of the installation companies, have been elected to the board.

Cork Electric Tramways and Lighting Co., Ltd.—Mr. A. R. Monks presided at the annual meeting on April 17th, and in presenting the report and accounts (ELEC. REV., April 10th, p. 587), said that the revenue had increased to a greater extent than the expenses. This, however, was due to the lighting and power business, for the tramway receipts were not sufficient to cover depreciation. They had reduced the fares, and unless the traffic increased considerably the results for the current year would be even more unsatisfactory. The lighting and power business made further progress, and prices had been reduced for the second time. A further reduction was contemplated. The question of income tax as between Great Britain and the Irish Free State had not been settled so far as shareholders were concerned, but advice was being taken on the matter.

Salisbury Electric Light and Supply Co., Ltd.—The balance on the past year's working, after providing for debenture interest, income tax, depreciation, &c., amounted to £7,314. After transferring £1,400 to reserve, a final dividend of 6 per cent., free of tax (making 10 per cent. for the year) was paid on the old shares, and a dividend at the rate of 10 per cent. per annum, free of tax, for six months on the new shares, leaving £289 to be carried forward. The installation of the new generating plant has been completed.

Indo-European Telegraph Co., Ltd.—The report for the past year shows a total revenue of £294,371, an increase of £96,586, and the expenses increased by £26,905 to £182,557. After deducting taxes, there is a balance of £107,060, to which is added £22,854, making a total of £129,914. After writing down construction costs, and deducting the interim dividend, there is an available balance of £64,290. As already reported, adividend of £1 2s. 6d. per share (making 7 per cent. for the year), together with a bonus of 7s. 6d. per share, both free of tax, is being paid; £10,000 is allocated to the retirement trust fund; £10,000 to the dividend equalisation fund; and £18,790 is carried forward.

Italian Companies.—The following Italian companies have increased their capital:—*Dinamo, Società Italiana per Impresa Elettriche* (Milan), from 30,000,000 to 40,000,000 lire; *Società Anonima Italiana Aparecchi Protezione Impianti Elettrici Elettroconduttore* (Milan), from 500,000 to 750,000 lire; *Società Italiana per Radiocomunicazione Circolaire* (Milan), from 5,000,000 to 6,000,000 lire; *Società Trasporti Autoelettrici* (Pesaro), from 500,000 to 600,000 lire; *Forze Idrauliche Trezzo sull' Adda* (Milan), from 30,000,000 to 60,000,000 lire; and *Società Idroelettrica Piemontaise* (of Turin) from 200 to 600 million lire.

Crieff Electric Supply Co.—At the recent annual meeting it was stated that after paying interest on loans and making provision for income tax there remained a balance of £1,027. The directors recommended that the balance of preliminary expenses, £209, be written off, that £424 be set aside for depreciation, and that the balance be carried forward to the next account.

Great Northern Telegraph Co., Ltd., of Denmark.—Out of the profits of the past year it is proposed to distribute a total dividend and bonus of 22 per cent. (5 per cent. already paid); to transfer £33,333 to reserve and renewal fund; to place £55,556 to the pension fund; and to carry forward £313,670.

Keswick Electric Light Co., Ltd.—The accounts for 1924 show a gross profit of £2,307. After adding £1,796 brought forward, defraying interest charges, &c., and transferring £500 to depreciation reserve, there is a balance of £583.

Northern Mexico Power and Development Co.—A dividend of 7 per cent. has been declared on the preference shares, clearing off arrears to January 1st, 1924.

Quebec Railway, Light, Heat and Power Co.—A dividend of $1½ per share has been declared on the common shares for the quarter ended March 31st.

Brush Electrical Engineering Co., Ltd.—The directors recommend a dividend of 10 per cent. on the ordinary shares for the year ended December 31st, 1924.

Brazilian Traction, Light and Power Co., Ltd.—A quarterly dividend of 1 per cent., payable June 1st, has been declared on the ordinary stock.

Hadfields, Ltd.—A dividend of 2½ per cent. has been declared on the ordinary shares, as against 4 per cent. in 1923.

Stocks and Shares.

MONDAY EVENING.

As the date of the Budget draws nearer, so investment business begins to feel the effect of the uncertainty which prevails, and to become contracted as a consequence. An income tax reduction has been so much canvassed in advance that if there should be 6d. taken off, the result is not likely to have any effect upon prices, although if the Chancellor is able to dispense with a shilling in the pound, of which there seems little likelihood, this would bring a stimulus to business in stocks and shares as a whole. Talk of a rise in the Bank rate has died down. The political crisis in France, having given way to calmer conditions at the moment, no longer acts as a contributory influence to the factors of hesitation. Nevertheless, business is quiet.

The strength which cable manufacturing shares developed in their recent boomlet is mostly retained, and no little interest is taken in the next dividend announcements of the companies whose shares have lately been the object of so much interest and support. Electricity supply shares keep firm: for the past few weeks the market has been moving on a very even keel, with fluctuations narrow and unimportant. As the two London electricity supply Bills are on the point of reaching the Statute Book, it may be useful to recall that, when these become law they will extend the companies' tenure for 40 years from 1931. In 1971 the capital assets will pass to a Joint Electricity Authority free of charge. The shareholders will be compensated through the operation of a sinking fund to be provided by them out of future receipts.

A sliding scale of prices and dividends will be set up. In regard to dividends up to 1931 inclusive, the standard dividend of a company is to be the rate paid in 1922, or else 10 per cent. on the ordinary share capital at the end of that year, plus 7 per cent. on ordinary share capital created by capitalisation of reserves and on new capital. From the beginning of 1932 the standard dividend is to be 7 per cent. on all ordinary share capital. The pivot around which discussion will revolve is the question of what will be deemed "reserves," and how these will be calculated. The finance of the leading London electricity supply companies has been conducted for years past upon a basis so sound as to render shareholders comfortable in regard to what is likely to happen when the matter of reserves comes to be dealt with.

"Summer-time" has caused no alteration in the prices of the electricity supply share market, the public having become too accustomed to the change for it to exert any influence over illumination shares such as it did, one remembers, when the reform was first introduced. Bournemouth and Poole are better at 2 13-16ths. Westminsters strengthened to 43s. 6d. The other changes consist of small falls in Bromptons to 35s., and London Electrics to 35s. 6d. English Electric 6 per cent. Consolidated Debenture has gone back to 107½. This stock is interesting from the conversion options which it carries. Each £100 is convertible up to July, 1927, into 100 ordinary shares; up to July, 1930, into 90, and up to 1933 into 80 ordinary shares. The yield on the money at the present price comes to 5½ per cent., with interest payments due in January and July. The stock can be redeemed any time after January, 1940, at 103.

British Automobile Traction 5½ per cent. debenture stock, obtainable at 93½, pays £5 17s. 6d. per cent. on the money with January and July dividends. Shropshire, Worcestershire and Staffordshire Electric 5½ per cent. first debenture stock at 103½ yields £5 6s., while South Wales Power 6 per cent. first mortgage debenture stock at 105 affords 5¾ per cent., with June and December interest. This last-named stock is redeemable at any time after 1927 at 103.

Amongst cable stocks the principal alteration is a rise of £5 in Indo-Europeans, which has lifted the price to 37½, following upon the advance in the dividend from 7 per cent. to 8¼ per cent., as mentioned here last week. The market in these shares is at all times a narrow one, and it required little demand for the price to be abruptly advanced. Eastern ordinary strengthened to 177½. Automatic Telephones are better at 36s. 3d.; United River Plate Telephones gained the fraction at 7 1-16th.

Marconis fell back to 1⅞, but recovered part of the loss occasioned by the news of the death of Mr. Godfrey Isaacs, who resigned the managing directorship some little while back, but who, it is thought, may have had a large holding of shares in the Marconi Co. Canadian Marconis are also dull at 5s. 3d., owing to the new shares having arrived from the other side of the Atlantic, and being sold, to some extent, by those who subscribed for them at 4s. 3d., and who can therefore take a modest profit. The wireless market, as a whole, is inclined to be heavy.

Home Railway stocks have fallen considerably. The steam stocks are substantially lower, the fall being due, this time, to the action of the Great Western in warning its staff that the company may find it necessary to effect reductions. Traffics are not good, and the Underground stocks have suffered with the others. Metropolitans show a fall of 1½. Districts are 10s. down, but the Underground Electric Railway issues have not changed.

Mexican Light & Power Preferred are the principal feature of strength, with a rise to 4 points, in their own particular market. The company's first mortgage bonds shed a point, which seems a little anomalous in view of the rise in the preferred. A slightly better tendency is noticeable amongst London traction stocks. London and Suburban Traction Preference strengthened to 6s. There has been a little support rendered to London United Tramways Preference and Debenture. A vague impression gains ground that the London tramways are now at the lowest ebb of their misfortunes, and that, from this time onwards, there should be some sort of a recovery, though on what lines rumour is content to remain silent. British Electric Traction ordinary and preference have risen to the common level of 107½. The Madras Electric Supply Corporation has issued this week 250,000 5½ per cent. tax-free preference shares at a guinea. To the advent of these reference was made earlier in the month.

Henleys are 9d. lower at 63s. 9d.; otherwise the cable manufacturing shares retain all their recent rises. Johnson and Phillips are a good spot at 32s. 6d. bid. Babcock & Wilcox advanced to 53s. 9d. Iron and steel shares continue heavy by reason of the prevailing, and popular pessimism in regard to the industry. The rubber share market shows signs of shaking off its indifference to the rise in the price of the raw material, but it cannot be said that the public give any indication of recognising the change for the better that has been developing quietly over the past three months.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1923.	Dividend. 1924.	Price April 20 1925.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole ...	1	13	14	2 13/16	+ 1/16	4 19 7
Brompton Ordinary	1	10	10	12	—	*5 14 3
Charing Cross Ordinary	1	14½	15	45/-	—	6 13 4
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	88/9	—	6 4 0
City of London	1	15	15	2 5/16 xd	—	6 9 10
do. do. 6% Pref. ...	1	6	6	28/6	—	5 2 2
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	15	15	2 7/8	—	5 9 1
do. do. 6% Pref. ...	1	6	6	28/-	—	5 4 4
Edmundson's Ordinary	1	7	—	24/6	—	5 14 2
do. 7% Pref.	1	6	—	23/-	—	6 1 9
Elec. Supply Corporation ...		10	10	31/3	—	6 8 0
Kensington Ordinary	5	14	15	12 3/8	—	5 18 10
Lancs. Light and Power ...	1	7½	7½	28/-	—	5 7 1
London Electric	1	10	10	35/6	—1/-	5 12 8
do. do. 6% Pref. ...	5	6	6	5 1/16	—	5 7 7
Metropolitan	1	10	11	38/3	—	5 15 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 8
Newcastle-on-Tyne Ordinary ...	1	6	7	23.9	—	5 17 11
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/6	—	5 9 10
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	1¼	—	5 6 8
St. James' and Pall Mall ...	5	17½	17½	13⅜	—	6 13 10
South London	1	15	15	2¼	—	6 0 0
South Metropolitan Pref. ...		7	7	1½	—	5 12 0
Urban Ordinary	1	4	—	1 1/16	—	3 15 4
do. 6% Pref. ...	1	6	—	20/6	—	5 17 1
Westminster Ordinary	1	15	15	43/6	—6d.	6 17 11
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/9	—	7 12 11
Yorkshire Elec.	1	8	8	30.6	—	5 5 0

Home Rails.

Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	4	5	77	—1½	6 9 10
do. District	,,	3½	3½	49	— ½	7 2 10
Underground Electric Ordinary	10	Nil	Nil	2¾	—	Nil
do. do. "A" ...	1/-	Nil	Nil	8/-	—	Nil
do. do. Income	Bonds	6	6	97	—	*6 3 9

Telegraphs and Telephones.

		Dividend. 1922.	Dividend. 1923.			
Anglo-Am. Tel. Pref.	Stock	6	6	103½	+ ½	£ 13 9
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	Nil	3	1 1/2	+ 1/16	3 6 2
Chili Telephone	5	6	6	6½	—	*5 9 1
Cuba Sub. Ord.	10	7	7	7½	—	9 13 3
Eastern Extension	10	10	10	17½	—	*5 14 3
Eastern Tel. Ord.	Stock	10	10	177½	+1	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18	—	*5 11 1
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	22	32	—	6 17 6
Indo-European	25	7	7	37½	+5	*5 13 4
Marconi	1	15	10	1⅞	—	5 14 6
Marconi Marine	1	10	10	1⅛	—	8 17 10
Oriental Telephone Ord. ...	1	12	12	9½	—	*5 12 11
United R. Plate Tel.	5	8	8	7 1/16	+ 1/16	*5 13 3
Western Telegraph	10	10	10	17½	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	8½	8¾	—	8 9 2
do. do. 2nd Pref. ...	5	6½	6	3	—	10 0 0
do. do. 5% Deb. ...	Stock	5	5	7⅛	—	6 17 0
British Electric Traction Ord. ...	,,	6	6	107½	+2	5 11 7
do. do. 6% Pref. ...	,,	6	6	107½	+1	5 11 7
Brazil Traction	100	4	4	53	—	7 8 2
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	5	96/-	89½	+1	*5 7 3
do. do. Deferred	,,	8	129/5	107½	+1	*5 0 6
do. do. Deb.	,,	4½	4½	78½	—1	5 8 3
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	6/-	+6d.	Nil
London United Tram. Deb. ...	Stock	4	4	47½	—	8 8 5
Mexico Trams, 5% Bonds ...	—	Nil	5	66	—2	7 11 6
Mexican Light Common ...	100	Nil	Nil	26	—	Nil
do. Pref.	100	Nil	Nil	61	+4	Nil
do. 1st Bonds ...	—	5	5	66½	—1	7 10 5
Yorkshire (West Riding) ...	1	—	5	1	—	5 0 0

Manufacturing Companies.

Babcock & Wilcox	1	20	12	2 1/2	+ 1/16	* 4 9 4
British Aluminium Ord.	1	5	5	1⅛	—	8 1 6
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	3 1/16	—	4 17 11
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3⅜	—	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	⅛	—	... ...
Edison-Swan	4/-	7½	10	7/6	—	5 6 8
do. 5% Deb.	Stock	5	5	81½	—	6 0 3
Electric Construction	1	10	10	33/9	—	5 19 10
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	8	5	18/3	—	5 9 7
do. do. Pref.	1	6	6	21/-	—	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	23/-	—	4 16 11
Henley	1	15	15	3⅛	—9d.	4 14 1
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	5	20/-	—	*5 0 0
Johnson & Phillips	1	5	5	1⅝	—	8 1 6
Met-Vickers, Ord.	1	12½	8	24/6	—	6 10 8
do. Pref.	2	8	8	2¼	—	6 8 0
Siemens Ord.	1	5	—	25/9	—	3 17 6
Telegraph Construction	12	20	20	27	—	*4 14 1

* Dividends paid free of Income Tax.

Packing Electrical Goods for Export.

How to Handle the Smaller Articles.

By A. JACOB.

The goods shipped abroad by the electrical equipment manufacturer are probably more varied in their style and requirements, from the packer's point of view, than any other material that he is called upon to handle. The manufacturer can, by insisting on high standards in his packing department, considerably cut his losses from breakage and pilferage, and by standardisation can keep down to the minimum the cost of packaging and dispatching his goods. He is in the unfortunate position that he must provide for materials as varied as electric lamps and electric motors, passing through various phases of the smaller equipment and branching continuously into the actual glass business and similar specialised lines. In practically everything he exports great care is required in the packing and securing. The majority of exporters of the heavier type of electrical product have formulated plans for handling such goods as heavy generators, motors, and even locomotives, so that the following notes will deal particularly with the smaller types of equipment, glow lamps, lighting fixtures, plugs and switches, storage batteries, fans, switchboards, and like equipment.

Safe Shipment of Glow Lamps.

The most general method of packing these products for export purposes, so far as this country is concerned, and quite a successful one, has been in use for something like fifteen years. Each globe is wrapped carefully in tissue paper, followed by a wrapping of corrugated paper, this being secured by the wrapper bearing individual descriptive matter. Each globe is separated from its companions by a layer of "excelsior" padding making them fit snugly in the box and preventing shifting. The outer box is lined with waterproofed paper, with an additional padding of excelsior both in the bottom and on top as an additional protective measure. A corrugated pad is commonly substituted for the excelsior. For the outer case a dovetailed jointed sound wood container is used, the corners being protected by an extra cushion to prevent jars if the box is dropped. The usual metal strapping is replaced by strips of wood right round the container at both ends which, besides taking a certain percentage of the jarring and acting as an ordinary security, assists in the prevention of skewing in transit. Ropes fitted to either end act as handles to facilitate lifting by stevedores, &c.

Another method, which has been rapidly gaining favour on the American Continent, and has much to recommend it, is packing in hogsheads, each one of which will contain anything from 400 to 500 lamps. First a layer of straw is placed on the bottom of the cask and then a layer of the lamps, each lamp being protected by tissue and corrugated paper as before. The lamps are packed on end, while above each layer is a layer of straw, then a corrugated board, another layer of lamps, and so on. The cask is lined lightly, and a twisted straw rope is fixed to act as a buffer.

The latest approved method of packing these goods, however, is as follows:—The lamp is first enclosed in a wrapper consisting of a sheet of flat unsurfaced corrugated paper to which is attached a fly sheet of kraft tissue paper. The ends of the kraft tissue are twisted, giving protection to the tips of the lamps. They are then wrapped in kraft paper, the ends of which are held together by gummed paper tape, making a neat compact bundle conforming to the shape of a box. They are then placed in cartons, and the cartons are packed in boxes made as nearly cubical as possible. Two inches of excelsior separate the contents from the inside of the boxing: a flat double-faced corrugated board will separate the layers. The boxes are finally well strapped with metal strapping.

This last method, owing to its great security, simplicity in packing and in estimating the contents of the full container, is undoubtedly gaining favour in all parts of the world, and it is thought will very shortly be the prevailing method in use.

Standard Practice for Lighting Fixtures.

A leading exporter of lighting fixtures recommends a box made of $\frac{5}{8}$-in. "Celotex" material; the frame of the case is of wood, with a three-way corner construction. (The three-way corner is the bringing of the three members of a crate corner together in such a manner that each member is nailed to another member, and has the third nailed to it.) Cement-coated nails are used, and three metal straps $\frac{3}{4}$ in. wide are nailed round the box, one in the middle and one at each end. The inside packing is practically the same as that used for the lamps.

Glass reflectors and indirect lighting bowls bring us into the glass industry; they are some of the most fragile of the material in the usual course leaving the warehouse, particularly owing to their inconvenient sizes and shapes. Greatest freedom from breakage has attended consignments when these bowls have been packed separately, each item being nested in excelsior and packed in a corrugated carton, then placed in a wooden container with a layer of padding between the carton and the exterior box. The universal term for this method of packing is "floating in excelsior." Seven-eighths-inch lumber is suitable for the boxes, and the ends should be cleated. Waterproofed case-lining paper is used for lining the wood box, and two metal straps at either end may with advantage be used as an additional security.

Reflectors can be packed individually in cardboard cartons, with partitions in the box to hold the separate reflectors apart. All free spaces are padded to prevent movement, with its consequent chipping effect. These cartons are in turn packed in boxes of 1-in. material, reinforced by cleats and bound in the middle by 1-in. strips of wood running all round the box, this strapping tending to take any jar. Metal strapping is used on the ends, and the outer container should be large enough to permit of the cartons being "floated" in padding. The limit weight for boxes containing such products should be not more than 500 lb. to allow of easy handling.

Using the methods described has cut down the breakage losses of shippers by a great deal, and it should be remembered that claims for well-packed merchandise which does meet with accident are more certain of success than claims for flimsily-packed material.

Switches, Plugs, and Switchboard Panels.

Sockets, plugs, switches, and other small articles are not so easily damaged as the materials we have already considered, and the following particulars should be sufficient to render shipment with the lowest possible losses from all sources a simple matter for all. The case may be of $\frac{3}{4}$-in. material, and is preferably tongued and grooved, with cleating at the ends. Three metal straps should be used, and the case lined with waterproofed case-lining paper and a medium padding. Cartons should be used for individual pieces or small quantities, these in turn being tightly secured in the outer case.

Turning, however, to switchboard panels and such equipment, the difficulties immediately increase, for considerable protection is required to prevent cracking.

Standard switchboard panels may be mounted on angle-iron frames and packed in waterproofed paper-lined boxes, with a 2-in. bed of excelsior packing around the sides and ends, and not less than 3 in. of padding between the bottom or top of the box and the greatest projection of switches or breakers on the board, and blocks should be placed across the box above

and below the panel so that the fixtures mounted on the panel cannot possibly rest on the top or bottom of the box; while, again, there must be a good layer of excelsior between the blocks and the panel.

The meters are removed and doubled boxed, *i.e.*, they are first placed in a specially-designed box, and these are in turn packed in an outer container with a 2-in. bed of packing all round.

Fans and Motors.

The awkward shape of fans in many cases leads to the packing being faulty, and consequently the claims for damage in this line are somewhat high. They may be shipped assembled or in parts. The latter method makes for a saving of over 50 per cent. in space, and is perhaps the more generally used method, especially with the larger types.

When they are shipped "knocked down," the motor and base should be packed separately in a corrugated box preferably with wood bracing. The fan and guard are packed in a flat three-piece corrugated box, the blades being wrapped in paper and placed inside the guard. The outside case holding the cartons containing dis-assembled parts should be specially constructed to take a certain number of these as a "tight fit." According to an American exporter, 9-in. fans are best packed twelve to a case, the blades, guard, and guard supports going 24 sets to the case, while 12- and 16-in. fan motors are packed six in a case, and the accessories 24 sets as before.

Assembled fans should be packed in all cases separately in wood boxes, while any convenient number, say three, of these boxes can be crated together.

In packing electric motors, all except the very smallest ones should be securely bolted to skids and shipped in a case well lined with waterproofed case-lining paper, as in the case of heavier machinery. Motors should be securely blocked to prevent undue strain on the skid bolts.

Accumulators.

These present another difficult problem to the packer, for besides being particularly fragile they are also heavy. A successful method is to pack the accumulators first in a light frame, holding on an average about five to six accumulators, separated from each other by a sheet of waterproofed card or corrugated paper. A layer of card should also be placed lengthwise in the frame or crate. Two sheets of waterproofed paper are laid on the top of the batteries, and on top of these a layer of padding as a final protection. The frame is then placed in a packing case floated in excelsior. A suitable case might consist of ½-in. to 1-in. lumber, and the box should be constructed with cleated ends. Three metal straps are used. They could, of course, be shipped without the double boxing mentioned, and, in fact, are commonly so dispatched, each cell being nested separately in padding and the case divided into compartments to hold the whole firm. Personally, where the amount of damage may be so high as in the case of a "break loose" in such a consignment, I would not favour any but the most secure method, which undoubtedly is the double boxing system.

Strapping, Tying, and Marking Export Containers.

The metal strapping mentioned throughout the foregoing notes may, of course, be of the nailed-on variety, but it is commonly found that straps applied under pressure give a far better result. It will be realised that where pressure is used, the shrinkage in the woodwork which may take place when journeying through warm countries, will, to a certain extent, be taken up by the taut metal band, which would not be the case with nailed strapping. Again, time is saved and it is undoubtedly impossible for the pilferer to remove a pressure-applied band, remove goods, and replace the band even if he has some hours at his disposal.

Wire tying is now appealing to many exporters, and has much to recommend it. This is most effectively applied under pressure by the machines on the market for the purpose. The waste in taking wire from the coil in certain of these machines is only about an inch per tie, and the speed of application a matter of seconds only.

The main considerations in marking export containers is to make the instructions perfectly intelligible, cutting out all unnecessary information. Where instructions are intended for a country where a foreign language is spoken, such instructions should be duplicated in that language where possible. Just recently I have seen cases where three languages are printed on the side. The shipper in this case obviously knew well the route his goods would take, and that besides being handled in this country and in that of the consignee, they must be reloaded *en route* in a third country where neither of the former languages would be intelligible.

Whether hay, straw, cotton waste, or similar material is barred as a packing material in the country to which goods are to be sent, should be carefully ascertained. Owing to the prevalence of foot and mouth disease, and the alarming spread of a cotton malady in recent years, certain countries have seen fit to bar the entry in any form of such produce except under special licence.

Electricity and Gas Cooking.

By E. G. ROSS, A.M.I.E.E.

The present controversial conditions respecting this subject merit serious consideration by all electrically inclined. The financial aspect of the controversy naturally occupies the most important position in it because people almost universally compare most things, if not consciously, certainly sub-consciously, in terms of £ s. d. The claims of cleanliness, health, less fatigue, &c., occupy a second place. Whether this be right or wrong is at the moment beside the point; the important fact to be faced is that all domestic users of electricity count the cost *first*.

It is very unfortunate that definite data regarding the subject are appearing only in a very tardy manner for, in all controversies of the kind, the respective protagonists assert this, and deny that, in such a general manner that the argument is everlasting and leads to nowhere. It is not implied by this remark that the data necessary can be obtained accurate to within one per cent.; this is clearly out of the question. However, a few experiments carried out in the most general of ways will bring to light much that is surprising, and it is on this basis that these comments are more or less supplementary to those made by the writer in an article published by the courtesy of the Editors in the Electrical Review of July 4th, 1924, in which it was shown that, in Glasgow at any rate, the electrical way was the considerably cheaper way. From what immediately follows this will be found difficult of belief, but further experience gained since then confirms that electrical cooking is, quite definitely, at least 15 per cent. cheaper overall than gas cooking, other conditions being equal of course.

Theoretically, however, it is *not* cheaper, as the following considerations will show. The actual advan-

tage of electricity over gas for cooking, in point of price, is due entirely to the economic conditions attendant upon its use, and it is not true to say that it is intrinsically cheaper than gas for the purpose. The electrical reader may rise in arms at this statement, but his attention is directed to what immediately follows.

Assuming that for any given article to be cooked 1,000 B.th.u. are necessary over one hour, and that the efficiency of the cooker is 100 per cent., the gas required is therefore .01 therm. As there are 3,410 B.th.u. in 1 kW-hour, the equivalent electrical energy required is .293 kWh. Now a reasonable price for the gas is 10d. per therm, and for electricity $\frac{3}{4}$d. per kWh. This means that the apparent respective costs for the cooking are: gas 0.1d. and electricity 0.22d., figures which are perhaps controversial. It is seen, therefore, that the electric energy cost has, *primâ facie*, considerable leeway to make up against the gas cost: but of course the overall efficiency is nothing like 100 per cent. The prime economical disadvantage of gas lies in the fact that a current of air is absolutely essential for the maintenance of the heat involving (*a*) a free ingress of air to the boiling ring, and (*b*) a definite minimum distance between the cooking utensil and the burner, so that no back-pressure is put upon the jet, and the consequences of this state of affairs are apparent. From data variously collected it would seem that, when boiling for approximately four hours in a pot about 5½ in. diameter, anything from a minimum of 30 per cent. to a maximum of 60 per cent. of the available gas heat is lost, due to these essential conditions of burning. This fact is probably the most serious with which the gas people have to contend. Assuming as low a value as 30 per cent. gas heat loss, the gas required in the example cited is 1,450 B.th.u. for the actual heat input of 1,000 B.th.u. to the article to be boiled. On the other hand, for the same time, pot, and article to be cooked, the electrical heat loss appears to vary from a minimum of 5 per cent. to a maximum of 12 per cent. because of the fact that the pot bottom may be as little as ¼ in. from the heating point, no air being necessary whatever for the proper functioning of the hot element, and taking 8 per cent. as an average figure, the corrected electric power equivalent is therefore 1,085 B.th.u.

Question might here be raised as to the authenticity of these efficiency figures. They were obtained by time measurement combined with meter readings of consumption and, also, by approximate calorimetric methods. The limits of efficiency are very wide, but the average figures taken are considered to be reasonably representative.

There is another point which is of some importance; the inherent construction of the gas cooker is such that, to comply with the aforementioned conditions, the means of supporting the cooking utensils must absorb heat from the flame; thus the gas cooker consists of a heavy top rectangular framework carrying crosswise supporting ribs for the pans, &c. The heat loss by conduction by, and radiation from, these ribs must be large. In many instances, after prolonged cooking, it is difficult to keep the hand on the frame, and, of course, quite impossible to touch the ribs without sustaining a severe burn. The electric cooker also contains a heavy top plate, but the elements are entirely separate therefrom, and no cross ribs are necessary, for, with a strong porcelain element support, it is perfectly feasible to set the pot right down upon the porcelain, which, from its overhanging construction, quite safely protects the elements from otherwise possible short circuit. The result of this is that, after four or five hours' cooking, the top plate of the cooker is little above air temperature, and in many instances remains quite cold (presuming that the grill is not used), any conduction to it taking place through the pot used, should this be too large to sit upon the porcelain. Naturally there is some heat loss due to the element heating up the porcelain, but this is quite negligible because, when the porcelain becomes red hot, it assists the element to heat the pot, a state of affairs which cannot be obtained with the gas ring. Indeed, it is recognised that to get the most out of the electric cooker, the expert user must be able to switch off the power an appreciable time before cooking is completed. It is very difficult to give definite data for the heat losses here, but if thermometer readings are any rough indication, then for cookers of the same output, which very generally have the same top perimeters and weight of metal, it will be found that, after the four hours' boiling referred to above, and for the same cooking, of course, the following approximate figures hold, *viz.*: Temperature round perimeter of top plate for gas cooker, 150-200 deg. F.; for electric cooker, 50-100 deg. F. The average values are 175 deg. F. and 75 deg. F. respectively.

The dimensions of an average electric cooker top are: perimeter 94 in., net area 320 sq. in., volume 60 cu. in. Taking the specific heat of iron at .12 to cover average conditions, the heat necessary to raise this mass to from 50 deg. F. to 75 deg. F. works out at about 51 B.th.u. Similarly, to raise it from 50 deg. F. to 175 deg. F., about 255 B.th.u. are required. These values will further alter the heat inputs in the example, and these now become: gas input 1,705 B.th.u., electricity input 1,136 B.th.u. per hour. This assumes that the heat absorbed by the frames is more or less constant in quantity, which is considered, to be taken as the case in practice, within reasonable limits. The actual figures of radiation from the frames cannot very well be stated, even in the general manner in which the whole subject is here being dealt with, but it is thought that the quantities worked out will be sufficiently accurate for the immediate purpose of the discussion.

So far an example of cooking (boiling) has been considered more or less in the light of the actual conditions obtaining at the heating point, and the main, possibly the only, losses occurring have been noted. At this point it would be convenient to express the relationship of the values of gas input and electricity input as a ratio. It is considered that the previous results are, by the rule of averages, sufficiently accurate to be used for the purpose, since it will be remembered that the balance of power cost lay in favour of gas; 10d. per therm is an average cost of gas, whereas $\frac{3}{4}$d. per unit for electric power is more often the exception than the rule at the present time. Therefore, within moderate limits and on a purely heating basis, it might be said that the ratio of gas input to electricity input for the same boiling is 1,705/1,136. To reduce errors to the least value, it will be best not to simplify this at the moment.

Now it is an established fact that, when cooking electrically, the quantity of foodstuffs required to be cooked is from 18 per cent. to 25 per cent. less than that required for cooking by gas. The reason for this has yet to be explained, although the suggestion that excessive oxidation losses occurring in gas cooking account for the practical fact may carry some weight. Anyway, the fact remains and cannot be disputed. It is clear, then, that the above ratio does not represent the actual *economic* position as against the actual physical position, that is to say, the example considered must be modified by altering the value of one heat input, to represent more correctly the overall conditions of the case. To consider equal or equivalent heat inputs only is to obtain a false conception of the relative costs. It is advisable to consider two identical completely cooked meals, it being recognised that the quantity of material necessary originally for the electrically cooked meal must be 21½ per cent. (average) less than that required for the gas-cooked meal. In other words, for a gas heat input of 1,000 B.th.u. the correct electrical heat input is only 785 B.th.u. Correcting the latter figure for the various losses considered, the ratio then becomes 1,705/903.

It is still, however, not quite within the necessary limits of accuracy, and the remaining correction is one which depends entirely upon the human element, resting as it does upon the amount of care taken by the user of the cooker. The gas burners are *continuously lit* over the whole cooking period. The electric cooker per-

mits of only the *necessary* power being used; no more and no less. The effect of this is far-reaching; just how far-reaching few electrical folk even seem to realise. To illustrate the point, convert here the ratio into a price ratio on the basis of the original costs given. It becomes .17/.199 in pence, *i.e., the gas charge is less by 14½ per cent. than the electricity charge.*

Over a period of nine months, observations have shown that with the electric cooker, the net effective cooking time (*i.e.*, the time during which current was actually flowing through the elements) varied from 60 per cent. to 87 per cent. of the time during which gas was burned, for the same general meals. In certain instances the value was as low as 53 per cent., but this was rare. Taking the average at 75 per cent. as a round figure, it will be seen that *economically* the ratio obtained must further be corrected to take account of the using of 25 per cent. less power by the electric cooker, due to the fact that it is more or less impracticable to keep on extinguishing and relighting the gas while, say, "pouring" potatoes, cabbage, and the like. Hence the ratio becomes 1.705/689 in power, and therefore .17/.151 in pence, *i.e.*, the electricity charge is now 11 per cent. cheaper than the gas charge.

Critics will doubtless find fault with many of the foregoing figures and statements, but it so happens that, taken overall, the writer finds them to hold in practice, for personal electricity bills show, on the average, 15 per cent. reduction upon the equivalent gas bills, at slightly dearer electricity rates and slightly cheaper gas rates than have been taken here as a basis. This practical result, therefore, confirms that the general method adopted of dealing with the subject is not far out when the important points are alone considered. The purely material influences have been dealt with in conjunction with the effect of the human element, and many more accurate figures could possibly only be obtained in the laboratory, but it is thought that these are unnecessary since the results obtained are somewhat remarkably borne out in actual practice.

It must therefore be reiterated that, intrinsically, electric cooking is definitely not cheaper than gas cooking, but, economically, it *is* so to the tune of approximately one eighth. The gas engineer may read this with mixed feelings, but he will find some consolation in the fact that the electric power charge taken is low compared to that obtaining more or less universally. Hence it does not follow that the cheap cooking eulogised will be found to hold in every locality. In point of fact, it does not, for in some districts the ratio of gas charge to equivalent electricity charge is much less than stated here. The narrow difference between the competitive rates is really a warning to the electrical engineer that the price of electricity is yet much too high for successful competition against gas when used for cooking purposes.

Moreover, it is but fair to state that where great lack of operative skill exists, it has been found that the power bills are from 1.4 to 1.8 times the equivalent skilled users' bills, on which basis, of course, any economical advantage of electricity is hopelessly wiped out.

The moral is obvious!

The Situation in Sweden.

A report, dated January, 1925, upon the economic, commercial and industrial situation of Sweden*, has been forwarded to the Department of Overseas Trade by Mr. H. Kershaw, O.B.E., the Commercial Secretary to the British Legation at Stockholm.

At the commencement of the report Mr. Kershaw says that 1924 was a year of normal prosperity for Sweden. The nation has become more reconciled to the tardy process of restoring the pre-war condition of Europe, and has consequently kept better step with the march of economic events on the European mainland. So far as State finance is concerned, few countries are in a sounder position to-day. Sweden has made rapid strides of late years in shipping, shipbuilding, and the manufacture of special kinds of machinery for export, apart from the maintenance of her well-established export trade in high-speed steel, pig iron, iron ore, &c. This has been accomplished without any radical alteration of the fiscal policy. There are powerful "fair-trade" bodies in Sweden which, by means of accumulated data, have sought to show that a too-high Customs tariff is a two-edged weapon, and have so far succeeded in arresting sweeping experiments in this direction. The association of the Government with such important enterprises as hydro-electric development and railways has not led to the stultification of individual initiative, as predicted; on the contrary, these concerns are efficiently administered. Although 1924 was little marred by strikes and lock-outs, contending impulses on the question of wages were a disturbing feature. The engineering industries were, as usual, principally affected, since this branch owing to a large proportion of the cost of the finished product being represented by labour, is more sensitive than, for instance, the iron ore and timber and pulp trades to foreign competition. Skilled mechanics are very dissatisfied with what they consider an unfair disparity between their wages and those in other industries. Swedish engineering firms are making every effort to cheapen production and this furnishes a partial answer to the oft-repeated question: How can Sweden, with the prevailing high wages and high rate of exchange, successfully compete in overseas markets?

Foreign Trade.

Although the returns toward the end of 1924 indicated the persistence of an unfavourable balance of foreign trade, there appears to have been an increase of about 5 per cent. in the volume of trade and a decrease of over 10 per cent. in the unfavourable balance as compared with 1923. Among the items which showed a decided improvement were electric motors and generators. Statistics appended to the report show that the total value of electric motors, generators, transformers, &c., exported during 1924, was 17,492,148 kr. as compared with 12,709,498 kr. in 1923. At the same time the value of exported telephone and telegraph apparatus decreased from 8,183,600 kr. to 7,519,045 kr. Internal combustion engine exports were valued at 8,666,891 kr. in 1924, as against 7,219,893 kr. in 1923.

The import list shows that electrical machinery and apparatus imported into Sweden during 1924 was valued at 3,991,812 kr., which was rather less than the 1923 figure (4,086,902 kr.).

The Engineering Industry.

This branch of industry had many difficulties to contend with during 1924 and the year was not a successful one. As mentioned above, wages were the principal cause of trouble. In certain directions there were improvements, however. The State Railway authorities are gradually electrifying their system, and it is gratifying to note that a certain amount of British material has been employed. There is also considerable activity in harbour construction in different parts of the country which will entail an outlay upon cranes and other goods-handling machinery. During the year pipes and tubes steadily decreased in price. Large quantities of these were purchased from Belgium in the first half of the year, but German and Czecho-Slovakian manufacturers began to quote lower prices in the middle of the year. German prices were subsequently raised again, but the Czecho-Slovakian firms maintained theirs. Generally, British prices for engineering production were on the high side; British manufacturers should make every effort to reduce them in order to keep their market in Sweden.

Hydro-Electric Development.

It is estimated that the total water power available in Sweden is 6,200,000 h.p.; about 40 per cent. of this, however, is situated in the extreme north and only about 3,500,000 h.p. can be economically harnessed. The number of water-power plants at work is about 2,100, of which 1,100 have been constructed mainly for supplying country districts with light and power. The amount of power in use was put at 1,345,000 h.p. at the beginning of 1924, an increase of 20,000 h.p. for the twelve months; this was rather lower than the average annual increase, though higher than during the two years immediately preceding it. At the beginning of 1924 work was in hand for the exploitation of a further 72,000 h.p., not including the work commenced but since relinquished at Harspranget and Torpshammar. In this figure are included the State power station near Lilla Edit, on the River Göta, for about 30,000 h.p., and the new plant of the Sandvik steel works at Lanfors, on the River Dal for about 33,000 h.p. In 1924 preliminary work was commenced for the increase of the output of the State works at Norrfors, on the Ume, by some 25,000 h.p. Plans have also been developed for the regulation of Lake Siljan, which would result in increasing the capacity of the stations on the River Dal by about 16,000 h.p. The total hydro-electric power production during 1923 is estimated at 2,956 million kWh, as compared with 2,683 million kWh in

* Stationery Office. 1s. 6d. net.

1922. The total capital invested in the industry is put at about 1,000 million kr.

About 40 per cent. of the total arable land is now provided with electricity. While the primary use is for lighting, motors are extensively used for all farming processes. Thrashing motors are largely employed by "thrashing companies," being mounted on special carriages and moving about from farm to farm. Experience has shown that two small motors will work all the machines on a 50-hectare farm. According to a Swedish authority the total load installed on electric farms is now about 260,000 kW, the annual consumption being 120 million kWh.

Railway Electrification.

Electrification and other improvements have rendered the State Railways adequate for the country's transportation needs for some years to come. During 1924 the number of locomotives on the Svartön-Rickgränsen line was increased by five ore-train locomotives, making a total of 50 locomotives and two electric motor-cars in operation on the line. The total energy consumption of the line during 1924 was about 60 million kWh, and the quantity of ore exported was 5 million tons. The electrification of the Stockholm-Gothenburg line proceeded according to programme. During the year most of the poles for the overhead lines were erected and the line is now ready over about 150 km. The work on the sub-station buildings has been commenced and the station at Moholm has been nearly completed. The first motor-generators, transformers, &c., have been tested and are ready for delivery, and the construction of the 50 electric locomotives has advanced. The installation of the sub-station machinery is to be commenced this year.

Telegraphy and Telephony.

There was a decrease in the number of telegrams dispatched during the first nine months of 1924, but inter-urban telephone calls showed an increase. The number of telephones has increased considerably, owing to the reduction of rates which came into force in July, 1924. At the beginning of the year the first entirely automatic exchange, installed by the Allmänna Telefonaktiebolaget L.M. Ericsson, was put into operation in Stockholm. It comprised 5,000 lines, but is being extended to 10,000 lines. It is hoped during the present year to install in Stockholm and Gothenburg automatic exchanges comprising 30,000 lines. An underground telephone cable, 177 km. long, was installed between Stockholm and Norrköping during 1924. The preliminary agreement concluded between the Swedish Telegraph Administration and the Great Northern Telegraph Co., of Denmark, has been approved in essentials by the Government.

The direct radio-telegraph service between Sweden and the United States was opened on December 1st. It is stated that the capacity of the station greatly exceeds the present amount of cable traffic with the United States which averages slightly over 200 messages each way per day.

The Swedish Government has authorised the Telegraph Administration to conclude an agreement with the Radiotjänst Company (Press Syndicate) for the rights to carry on broadcasting for a period of two years. The licence fee for receiving apparatus (half of which is to go to the Telegraph Administration and half to the company) has been raised from Kr. 3.50 to Kr. 12 per annum, whilst that for loud speakers in public premises or for advertising purposes has been fixed by the Government at not less than Kr. 50 and not exceeding Kr. 200 per annum, whereof 25 per cent. is to go to the Telegraph Administration and the remainder to the company. It was expected that the broadcasting service would be in working order by the beginning of 1925, when, as promised by the Telegraph Administration, at least two transmitting stations, those at Stockholm and Boden, were to be completed. Wireless business in Sweden has not progressed as rapidly as was anticipated, which is partly due to the delay in erecting the broadcasting stations, in anticipation of which dealers placed considerable orders for material which they expected to sell last autumn, and they therefore had large stocks on hand. There should, however, be a revival in the demand when the services are in full swing. The greater part of the wireless material used in Sweden is imported, Great Britain being responsible for probably the major portion of broadcasting receiving sets or parts. Up to December 18th, 39,180 licences for the possession of radio receiving apparatus and 99 licences for the possession or use of transmitting apparatus had been granted.

Information for Traders.

Mr. Kershaw devotes some space to hints to traders. He states that the pre-war practice of conducting Swedish business through an agent in one or other of the other two Scandinavian countries is to be avoided; there is an ever-increasing antipathy among Swedish traders towards this sub-agency custom. British commercial travellers and representatives are recommended to devote more time and personal effort to a detailed investigation of local conditions. It is unwise to leave the task of popularising imported articles to local firms. British firms who desire to create a market, particularly in proprietary or household goods, should render reasonable financial assistance to the local agents, after careful study of local conditions, for the purposes of advertising, in addition to granting other facilities, especially in the initial stages. British travellers are warned not to confine their attention to the principal cities. There are many thickly populated districts in other parts of the country where the national industries are carried on.

Modern Electric Cookers.

A RECENT visit to the showrooms of the Jackson Electric Stove Co., Ltd., enabled us to see some of the improvements which the company has introduced in the design of its cookers which are helping to bring the electric cooking stove nearer to perfection.

Fig. 1.—The No. 20b Jackson Cooker.

Probably the principal improvement effected recently on the Jackson cooker is the placing of the controlling switches and fuses on the side of the stove, instead of in the old position under the hob, thus affording a considerable increase in plate space under the hob. The switches now being used on the newer designs of the cookers are of the rotary type, but constructed so that they can be operated in either direction, thus avoiding the necessity of switching through all the forward steps in order to switch to a step one back, as is the case in many of the older designs. The switch handles

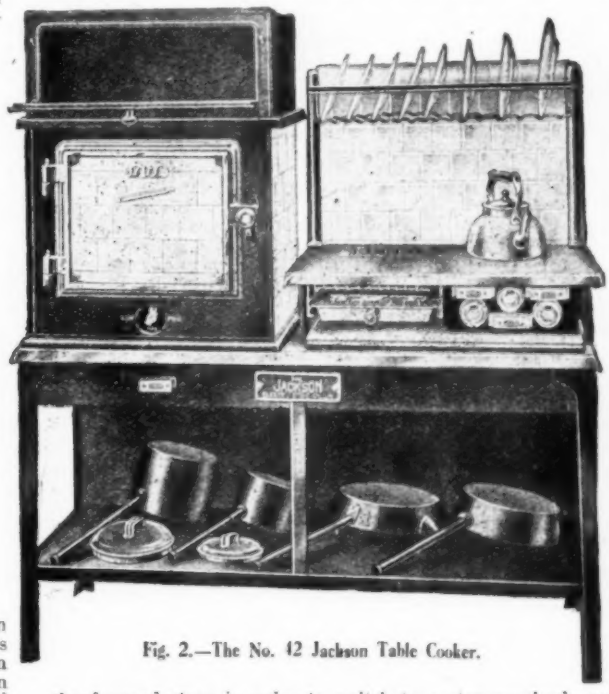


Fig. 2.—The No. 42 Jackson Table Cooker.

are of white porcelain, and are arrow shaped so as to indicate at a distance the position of the switch.

Fig. 1 is an illustration of the Jackson No. 20b model. This cooker has been specially designed for housing schemes, flats, &c., where space is a vital question. In this design, by reducing the hob dimensions of a previous design, the makers have been able to reduce the overall width of the cooker to 23¾ in. without reducing the oven dimensions.

It will be seen that the hob has a combined grill and boiling plate and an additional boiling plate, these and the oven being provided with the usual three-heat regulation. The combination grill and boiling plate should prove extremely economical in use, as the one heater will grill or toast anything underneath the hob while boiling or frying operations are being carried out on top. The hob is hinged for cleaning purposes, and is held in position, when raised, by an automatic locking device. The loadings are:—Boiling plate (8 in. by 6 in.), 1,500 W; grill-boiling plate (10 in. by 8 in.), 1,800 W; and oven, 1,650 W, making a total consumption of 4,950 W. The makers claim that, normally, 40 kWh will cook for a week for a family of six. The models Nos. 19 to 23 are all of a similar design, ranging from No. 18 for two to three persons, to No. 23 for 10 to 12 persons. The No. 24 Jackson is considerably larger, and suitable for cooking for 12 to 14 persons. The hob of this cooker contains three boiling plates, two of them being butted together to form a large plate, 12 in. by 8 in., to allow for a larger utensil. The grill is arranged as in the smaller cookers, so as to heat the hob as well. The No. 42 table model is a very convenient design, and consists of the No. 22 (nine to 10 persons) oven and hob side by side and mounted on a steel table. This design is particularly suitable where space is not an important item, as the oven is placed so as not to necessitate stooping. A ledge underneath the table affords a convenient storage for cooking utensils, while a hot cupboard fitted above the oven makes a very valuable addition. This table cooker, which is illustrated in fig. 2, is suitable for nine to 10 persons, and its total loading is 6,500 W.

The crown plates in all the types of Jackson cookers are troughed in front so that any liquid which may be spilt will be caught. The crown plates are also removable so that they may be used as pastry boards. The enamelled tiled pattern door, side and back panels give a very fine finish to all the cookers. The oven elements are easily accessible and detachable from the bus-bars, and old or damaged heater coils may be removed from the insulating mountings and replaced by new ones, which can be purchased separately.

Any of a list of several extras, such as a thermometer, nickel-plated finish, &c., may be had with any of the cookers. The Jackson Electric Stove Co., Ltd., also make several larger types of cooker, suitable for bakeries, &c. Their standard double-oven range consists of two standard ovens surmounted by one continuous hot-table with a space between the ovens for use as a hot cupboard and loaded up to 500 W. The total loading of this range is 22.7 kW. It is 72 in. wide, 32 in. deep, and 36½ in. high, and weighs 1,204 lb.

Some Colliery Power Supply Problems.

Economic Aspects and General Considerations.

By J. F. PERRY.

(*Abstract of Paper read before the* LONDON BRANCH *of the* ASSOCIATION OF MINING ELECTRICAL ENGINEERS.)

WHEN considering any colliery power scheme the winder is often the controlling factor. There is undoubtedly ample scope for both steam and electric systems and, as the subject of reliability may be taken as closed, the problem is to define the economic conditions determining the system to be installed.

Scheme A.—The simplest case for the electric winder is where a public power supply exists with ample generating capacity for the colliery loads and a tariff for power economically within the reach of the colliery. We are becoming accustomed to regard the super power station as a solution of the problem of cheap power for all purposes, but collieries constitute one of the exceptions. Generally most collieries could generate electricity for ¼d. per unit, including all charges.

To be relieved of the worry of generating plant is worth a certain amount of money annually, exactly how much can only be decided by the colliery company itself. I personally would suggest 0.2d. per unit as a maximum, making the total charge 0.7d. per unit (flat rate). If power can be purchased at a figure not exceeding 0.7d. per unit, then in the majority of cases complete electrification will prove the most economical method of operation. Local conditions, of course, provide exceptions and many economical compromises may be made at much higher tariffs. The problem of the disposal of so-called valueless coal at the collieries is often the excuse for some very unsound engineering. For instance, in eight of our leading power stations, the fuel costs average about 17 per cent. of the total selling price, whereas the capital charges average probably about 30 to 40 per cent. An interesting example of the above point is afforded by the conditions at Niagara, where the cost of production in both hydro-electric and steam generating stations is practically the same.

Scheme A1.—Where the public supply companies impose charges for maximum demand or bad load factor, a combination of public supply and Stubbs-Perry winder equipment may be advantageous. The coal winding would be done by the Stubbs-Perry winders, thus relieving the power company of the heavy peaks imposed on the system by the winder load. During the non-coal winding periods the boilers which operate the Stubbs-Perry winders would be banked and the winders operated electrically from the public supply, the turbine being declutched. The load factor would thus be very much higher and might enable the power company in many cases to quote very satisfactory tariffs.

Where no public supply is available the power problem has three solutions:—

Scheme B.—Steam winders and mixed-pressure turbines are at the best only a compromise. Their adoption in the case of entirely new schemes depends on the relative proportion of the exhaust steam to the auxiliary load requirements. The steam consumption of the winding engine does not play such an important part as is often imagined; the most efficient set of conditions may be defined as follows:—Three coal winding shifts, and the amount of exhaust steam exactly equal to the auxiliary load requirements, and the further the departure from these ideal conditions in either direction, the stronger the case for the use of high-pressure condensing turbines. Another feature which is often overlooked is radiation and other losses during the non-coal winding periods. The coal consumption for maintaining steam during the non-coal winding period seems to vary from 20 to 50 per cent. of the coal used during the coal winding period.

Scheme C.—A power station for all purposes. It is only possible to guess what the final power requirements will be. Moreover, the capital expenditure necessary at the commencement is such that some years must elapse before it could be economically utilised. Therefore colliery companies prefer the more gradual development possible with steam engines and mixed-pressure turbines, in spite of the lower efficiency of the scheme as a whole.

In view of the difficulties and the present uncertainty of the coal world, it is extremely unlikely that any new coal field will commence with a complete electrification scheme. The economic operation of a large power station depends largely on its load factor, or on operating on a load of such a nature as to ensure adequate return on its initial capital cost. If, as in the case of a colliery station, the load follows a definite time cycle, then an increase in the number of pits supplied, necessitating a larger power station and an increase in capital cost, does not necessarily improve the load factor. If, however, a station supplies a large number of industries operating on varying time cycles, then it is possible that any increase in the demand may improve the load factor. This fact probably explains why small stations exist with lower tariffs than some of the super power stations. In other words, the capital expenditure warranted on any proposed station is limited economically by the load factor.

The above facts explain why the Stubbs-Perry scheme in many cases proves more economical than a central power station. Where the winder load represents a small proportion of the total colliery load, say under 0.5, then undoubtedly a central power station for all purposes would prove the more economical solution. When, however, the winder loads are approximately equal to the remainder of the colliery load or in excess of the load about the colliery, then a combination of Stubbs-Perry winders and a central power station would probably be much more favourable. Providing the conditions are suitable to enable a central station to operate efficiently, then there is no doubt as to the resulting economies.

Scheme C1.—Where the winder load is equal to or exceeds the auxiliary load about the colliery or collieries, a power station for the auxiliary load in conjunction with Stubbs-Perry winders should be considered. The Stubbs-Perry system is new; its underlying principle is the economic consideration, and its conception was brought about by a thorough appreciation of the economic facts already explained above. Power for the auxiliary load can be developed as and when required, and the expenditure required to lay down a colliery is not only less than for either a power station or mixed-pressure turbines

and steam winders, but the rate of expending the necessary capital can be arranged in easy steps. The separation of the heavy fluctuating winder loads from the main station effects very far reaching economies:—(1) The capital cost of the station is reduced as the peaks due to winding are not capitalised in any way. (2) Transmission lines, switchgear, and general distribution system are considerably cheaper and of much smaller capacity. (3) The power station for the auxiliary load also acts as a standby for the winding equipment. (4) Efficiency of individual winding plant is at least equal to, and in many cases better than, the most efficient complete electric power scheme.

The Stubbs-Perry scheme consists of a high-speed condensing turbine driving through reduction gears and the clutch of Ward-Leonard generators and flywheel. On the opposite end of the set an induction motor is added, which normally operates as a brake, but may also operate the equipment as an ordinary electrically-driven Ward-Leonard winder, under which conditions the turbine is declutched and the induction motor takes its power from the general supply. This feature enables economies to be effected during the non-coal winding periods, as the individual boiler plant at the collieries would be banked and the equipment connected to the main power station, thereby improving the load factor of the station at a time when the load about the colliery for other purposes is extremely low.

Under coal winding conditions the equipment is driven by a turbine which relieves the power house of the winder load. The induction motor under these conditions operates automatically as a brake to take care of any regenerative energy over and above the amount which can be absorbed by the inertia of the flywheel equipment. An illustration of this feature is the lowering of men into the shaft unbalanced; it is quite feasible to assume that the flywheel equipment would be running at its light-load speed, and that as the men were lowered the winding motors would load back on to the generators, tending to speed up the set. This has the effect of closing the turbine governor and at the same time exciting the field of the induction-motor brake, which exerts sufficient braking effort to limit the speed of the equipment. This scheme is operating very successfully in a Yorkshire colliery, and it is claimed by many that it satisfies a long-felt need in the economic supply of power to a colliery.

The following figures represent a very careful investigation carried out by the author to compare the capital and operating costs of a power scheme for a group of eight collieries. Two schemes were considered:—(*a*) A central power station to supply power for all purposes, including winding, and (*b*) a Stubbs-Perry equipment on each winder and a central power station for the auxiliary load only. Table I is a *résumé* of the results:—

TABLE I.

	Scheme *b* £	Scheme *a* £
Interest and depreciation, repairs, maintenance, rates, taxes, oil and stores	50,050	40,900
Coal at 10s. per ton	24,300	21,740
Labour	2,550	4,950
Total	£76,900	£67,590

It was apparent from the investigation that in order to be competitive with scheme (*b*) the load factor on (*a*) required to be 75 per cent., whereas the highest possible with a pure colliery load is only about 60 per cent. The capital cost is also considerably in favour of scheme (*b*) as the capital cost of the necessary power station, transmission lines, switchgear &c., was very much less. It was also very apparent that considerable financial advantage could be claimed for scheme (*b*) due to its flexibility over the development period, which it was proposed to extend over some eight years.

The Stubbs-Perry scheme would also prove very economical in the case of a large isolated colliery, and a comparison between (1) winders on the Stubbs-Perry principle and high-pressure turbo-alternators for the auxiliary load, and (2) steam winders with mixed-pressure turbines for the auxiliary load shows a difference in favour of scheme (1) of 0.33d. per ton hoisted. On the large output contemplated at this particular colliery this represents an annual saving of approximately £3,000.

TABLE II.

	Scheme.
Public Supply Available.	
Ample power capacity and tariff of 0.5d./unit flat rate	A
Ample power capacity and tariff of 0.7d./unit flat rate	A or A1
Ample power capacity but penalisation for bad load or power factor	A or A1
" " but tariff over 0.7	B, C, or C1
No Public Supply Available.	
Where the winder load is approximately equal to the auxiliary load	B or C1
Where the winders are comparatively unimportant as compared with the total auxiliary load, say, less than 0.5 of total load	C
Where the winder load exceeds 0.5 of the total load	C1

Table II is an approximate *résumé*, serving as a rough guide for investigation, together with the following figures, which are based on current prices and represent average colliery practice:—Brick and steel buildings cost from 8d. to 1s. per cu. ft. The prices of Lancashire and water-tube boilers for quantities of steam not exceeding 80,000 lb. per hour are practically equal; the cost is £280 per 1,000 lb. of steam, including chimney, mechanical stokers, and settings. Chimney cooling towers cost, per 1,000 lb. of steam, £33 for jet and £40 for surface condensers, plus 25 per cent. for pipe work and 70 per cent. for excavation and foundations.

Steam winders, including drums, brake engine, and all control gear, cost from £18 to £30 per shaft h.p., the figures being approximately the same for 3-phase geared electric winders; for Ward-Leonard plant the cost is 1.7 times that of the 3-phase equipment. Transformer plant costs 12s. per kVA for units of from 500 to 3,000 kVA and 10s. per kVA for units of from 3,000 to 5,000 kVA, while the cost of turbo-generating plant is as follows:—

1,500 kW h.p.	£6.9 per kW
3,000 kW h.p.	£5.34 " "
6,000 kW h.p.	£4.54 " "
1,000 kW m.p.	£8.95 " "
750 kW m.p.	£9.35 " "

For an ordinary station of from 6,000 to 20,000 kW of installed plant as in scheme *C*, the total cost would be £15 5s. per kW. The author considers that there is much scope for economy in the power section of a colliery and he would like to see more co-operation between the colliery companies themselves with a view to increasing the efficiency, not only of the generating, but other plant about collieries. In this connection Table III is of interest.

TABLE III.—*Distribution of Coal Output in Britain and U.S.A.*

	Britain. Per cent.	U.S.A. Per cent.
Export and foreign bunkers	35	5.3
Metallurgical works	5	21.6
Gas works	6	0.9
Electricity generating works	3	5.8
Railways	5	27.9
Coastwise bunkers	1	0.7
Colliery consumption	6	2.2
Domestic use	16	13.3
General manufacturing and miscellaneous uses	23	25.3
	100	100.0

To obtain the average consumption of energy per ton raised for Great Britain, kW-hours per ton have been collected for a large number of all-electric pits of different depths, outputs, &c., in various districts, so that they may be considered to represent a fair average of collieries in this country:—

South Wales	32 units/ton raised
South Wales	25 " "
Newcastle (average of 6 pits)	21.5 " "
Newcastle	8.15 " "
Newcastle	7.5 " "
Yorkshire	12.0 " "
*French Pits, Pas-de-Calais (average of large group)	13.5 " "

Average = 17 kWh per ton raised.

The annual output of coal for Great Britain is about 260,000,000 tons, 6 per cent. of which is consumed by the collieries themselves for power-generation purposes. If the whole of the collieries were electrified the total consumption of energy would be approximately $260 \times 10^6 \times 17 = 4{,}430 \times 10^6$ kWh, which at 2 lb. of coal per kWh $= 8{,}860 \times 10^6$ lb. of coal, or 3,950,000 tons, showing a yearly saving of 11,650,000 tons of coal. If the coal is valued at 10s. per ton, this equals £5,875,000.

Not only is this coal being wasted at present, but labour, or its equivalent, is being expended in handling it. The average stoker will fire about one ton of coal per hour, and receives approximately 1s. 6d. as wages per ton fired; therefore, the cost of labour on 11,650,000 tons is £870,000, or a total yearly saving of £6,745,000.

The above figure is in the author's opinion certainly on the low side, as the electric drive would undoubtedly enable the general efficiency of the power plant about the colliery to be improved, with a corresponding increase in saving of fuel consumed. Furthermore, no figure has been included for the cost and inconvenience of disposing of the ashes, &c. Other points in favour of electrification are convenience and the facilities it offers for checking waste and inefficient operation. The reconstructed collieries in France are all electric. They have a central technical committee whose chief consideration is to prevent inefficient operation and to control technical co-operation between the collieries. The destruction of the French collieries might be regarded 20 years hence almost as a blessing in disguise. It relieved many colliery companies of inefficient methods and plant, clearing the way for modernisation and technical co-operation.

Discussion in London.

This was the last meeting of the 1924-25 session of the Association. Mr. J. W. GIMSON, hon. branch president, was in the chair.

*The French pits in the Pas-de-Calais area have been included, as the figure of 13.5 is the average of a large number of pits whose programmes and conditions have their counterpart in a large number of instances in this country.

MR. S. H. RIPLEY opened the debate by declaring that the excellent paper could be regarded almost as a standard work on the subject. Speaking as an ex-supply company official, he was naturally attracted to scheme A, and his feeling was that when two parties, such as a supply company and a colliery company, both had commodities which each other needed, there was always room for discussion with regard to an equitable tariff. In many cases colliery companies were probably forced to adopt alternative schemes, whereas, by full discussion, equitable arrangements could probably have been made. Poor coal, which the colliery companies said they could not sell at any price, he considered could be burned on special grates and, by arrangement with all the collieries in a district, probably suitable grates could be installed by the supply authority, so that there would be a market for the poor coal. A bad load factor and big demands must be paid for, and he felt that Mr. Perry's figure of 0.7d. per kWh on a flat rate was very low. Also, the 50 per cent. which he had given as the load factor of a colliery, was very much higher than was achieved in practice; it was generally in the region of 25 per cent. Mr. Perry had not mentioned, in connection with scheme A, that there was such a thing as an equitable coal clause which could be inserted in agreements and would probably have a great bearing upon the tariff. It was very unlikely nowadays that any supply company would offer a flat rate. He was surprised to find that the Stubbs-Perry system was applied to Ward-Leonard winders; the peak on a Ward-Leonard system was not great, and was one which the average supply company would not object to. If it were necessary to lay out capital to provide a turbine, with all its accessories and maintenance and attendance costs, the money could be better spent probably in providing a proper Ward-Leonard system with a motor only, possibly with some form of power factor correction, which would be also another means of reducing the tariff generally for the colliery. Directly-connected 3-phase winders, either geared or otherwise, had a very appreciable effect on the voltage regulation, even of a large power system. In several cases where heavy direct-connected winders had been installed at the end of a long transmission line, the supply companies had been put to enormous expense in providing regulating apparatus when the time came for giving local supplies, say, to adjoining villages.

MR. J. A. B. HORSLEY thanked Mr. Perry for having given the members of the Association the benefit of such figures as he had been able to collect, because very few colliery companies kept accurate records. The keeping of such records, especially with regard to output, would be very desirable. Power companies had a very difficult problem to solve in quoting a tariff which was attractive; it would appear that the colliery companies must be able to beat them every time, for, although generation by the colliery companies might be less economical, counting capital charges, the power companies had to face a very serious additional capital outlay and maintence charges in connection with the distribution system. The combination of a local power station for the "auxiliary load" and a Stubbs-Perry winder, both sharing one boiler house, certainly appeared to be an attractive scheme. Collieries and groups of collieries were, however, operating with a central power station of their own and direct drives with 3-phase motors. That was a very simple scheme, although possibly from the points of view of ease and smoothness of operation (and perhaps running costs) it was not so attractive as the Stubbs-Perry winder, plus separate generation for the auxiliary load. For the early stages of development there was a good deal to be said for the a.c. direct-driven winding engine without a flywheel or regenerative control for the pit-sinking stage when the loads were comparatively small. When the colliery began to develop, however, the time came when it was necessary to consider seriously whether they should have a Stubbs-Perry winder, or a steam winder, or some other alternative. On the North-East coast there were mutual arrangements whereby the colliery companies bought from, and sold to, the power companies. The other extreme was to be found in South Wales, where a colliery station dwarfed the power company's station. In that case the colliery company had catered for all the peak loads; it generated for a large group of collieries and did everything on a very big scale, and the peaks were smothered. The diversity factor was sufficient to take care of that. Possibly something of that sort might operate to the benefit of the power companies in such a district as Yorkshire when they got sufficient business. There was undoubtedly a good deal to be said for electric winders from several aspects: control of the speed was perhaps more perfect and simple, though it was practised with plain steam winders. The travelling was certainly more pleasant, and if changes in the rate of acceleration could be avoided, it must be better for the rope.

MR. J. R. COWIE said that when considering the electrification of certain pits in Scotland, he had found that at certain stages it would not pay. To some extent electric winding was being condemned, but he was convinced that it was the correct thing, and there seemed to be a depth beyond which electric winding commenced to pay. Also not a little of the loss attributed to electric winding was due to the arrangements at the pit bottom not being satisfactory; the coal was not loaded quickly enough for the electric winder.

The HON. BRANCH PRESIDENT believed there was much difference of opinion with regard to electric winding, particularly in the shallower collieries; in West Durham and West Northumbrian collieries a good deal had been said against electric winding. A power station supplying a number of collieries, and preferably also a number of other industries, was in a better position to burn low-grade fuel than other stations, perhaps as pulverised fuel, though in most cases it had proved successful with the aid of balanced draught and special apparatus for conserving heat energy and treating the gases. In some cases where such fuel had been used, the ash content was as high as 27 per cent., and yet that coal, which could not be used previously by colliery people, was purchased by the power supply company. Riding with electric winding was comfortable, and instead of the disturbing jerk at the centre on the way down, the travel was much more even and pleasant.

MR. J. F. PERRY, in reply, said he would not recommend a colliery to pay more than 0.7d., and a number of power companies had made arrangements this year to supply collieries at that figure. His figure for load factor was a maximum. At some of the bigger Yorkshire pits it was possible to get a 50 per cent. load factor, but no more. If colliery proprietors had a free hand and were independent of the men and the unions, they could get a better load factor, but at present when they were all working on more or less the same time cycle, the addition of a number of pits to a station did not necessarily increase the load factor, though the capital expenditure was increased enormously. That was where the Stubbs-Perry scheme showed remarkable economy. With the Ward-Leonard equipment equalisation by means of a flywheel was relative. In his own illustration the variation in eight seconds was from about 200 to 1,550 h.p., which a large power supply company would not consider enormous, but in that particular colliery, where the load was only a few hundred h.p., it was serious. Again, with the power-factor correction property of the motor driving a Ward-Leonard winder, he did not agree, because he did not consider it right policy to attempt power-factor correction with machinery on which the load fluctuated over such wide limits; although there was a certain advantage to be gained, the peaks were capitalised right back to the power station, and it did not pay to capitalise peaks. The 3-phase winders directly-coupled to the drums on the North-East coast and in South Wales were installed when the experience behind gear-making was not what it was to-day. The low-speed a.c. motor was ruled out to-day on account of its enormous first cost. The question of swamping the peaks was one which could be investigated with advantage; in the South Wales organisation the peaks did equalise themselves and caused no inconvenience on the power station busbars, but there was a buffer action due to the reactance of the lines, the transformers, &c., between the individual colliery and the power station, and there was a certain amount of inconvenience by voltage drop in the colliery itself. Again, though the switchgear and cables were apparently well within their rated capacity, there was a tendency for them to heat, due to the r.m.s. value of the current being a good deal above the actual value for which they had been installed. In a good many cases larger switches and cables had been put in. That the electric winder was more favourable from the point of view of the life of the ropes was quite definite.

Hydro-Electric Development in Quebec.

THE year 1924 was the most active in water-power development of any in the history of the Province of Quebec. This statement applies not only in the matter of new hydro-electric power installations actually brought into operation (amounting to some 175,999 h.p.), but in greater measure to developments actually under construction and nearing completion. Of the projects completed and brought into operation during the year the largest was that of the St. Maurice Power Company at La Gabelle on the St. Maurice River (a tributary of the St. Lawrence), with an installation of 120,000 h.p. This plant, embodying the most up-to-date features of hydro-electric design, was constructed in record time well in advance of the preliminary programme.

Among the numerous sets of plant under construction, and likely to be finished in the very near future, the most outstanding is that of the Duke-Price Power Company at the Grande Décharge on the Saguenay River. It is expected that the initial installation of eight sets, totalling 360,000 h.p., will be in place ready for operation during the present year. This, however, is only part of a project planned for execution at this spot on the Saguenay River, and the scheme as a whole contemplates the provision of up to about 1,200,000 h.p. of electrical energy, making it one of the world's greatest power centres. The Isle Maligne station is situated eight miles downstream from Lake St. John on the Saguenay River, 125 miles to the north of the city of Quebec. The lake has a surface area of 380 square miles at low water and its drainage area extends to 30,000 square miles. From its size and position, therefore, it forms a natural reservoir and prevents sudden rise and fall of the great tributary of the St. Lawrence, whose waters are the source of this new supply of industrial power. The discharge varies from about 12,000 cu. ft. per second towards the end of the winter to a maximum of about 200,000 at the beginning of June, when the volume of melting snow and ice causes the river to reach its highest level.

The first stage of the development provides for the construction and installation of twelve sets, operating under an average head of 110 ft. at 112½ r.p.m. and developing 45,000 h.p. each.

Eight of these are now being installed, and the other four sets will bring the total development at this point up to 540,000 h.p. The first two sets were to be put into operation soon after the beginning of this year, and it is expected that the whole of the first stage of the development will be completed by the middle of the summer. The second stage of the scheme, providing for a power plant lower down the river to operate under a higher head than the Isle Maligne plant, has not yet been begun.

The main portion of the power house consists of a combined gravity dam and generating station, 720 ft. long, with bulkhead extension to the north end, 330 ft. long, and tailrace walls carried down stream at either end at right angles to the building. The intake of each turbine is formed by twin rectangular openings, 16 ft. by 22 ft. in the concrete wall, each controlled by a butterfly valve. These converge into one, in which the rectangular section is gradually changed to a circular one running into the 22-ft. diameter steel penstock, which carries the water to the plate steel spiral casing. The latter surrounds and is riveted to the speed ring, a massive cast-steel erection, 21 ft. 6 in. in diameter, consisting of top and bottom machine-faced flanges with interconnecting ribs, between which the water is delivered to the runner. It is built up of five sections bolted together, the total weight being fifty tons. Twenty guide vanes regulate the flow of water. The runner is of cast iron, of 15 ft. maximum diameter, cast in one section, and is connected to the generator by the main shaft, 28 ft. long and 29 in. in diameter.

There are, in addition to the main structure, seven spillways and an earth dam. About half a million cubic yards of concrete will be used in the various structures forming the power-house and spillways and about 300,000 cubic yards of mainly rock excavation were required for the foundations and tailrace, the total excavation of various materials reaching little less than a million cubic yards.

The generating plant is being manufactured at Toronto and Montreal by the hydraulic departments of the Canadian Allis-Chalmers, Limited.

The construction of the plant and the station is proceeding at a cost which it is claimed will make the power produced the cheapest on the American Continent. Messrs. Price Bros., Ltd., pulp and paper manufacturers, will take under contract 200,000 h.p. in connection with their manufacturing activities in that neighbourhood, but the vast amount of cheap power in sight during the next few years offers a unique opportunity for the establishment of electrometallurgical and electrochemical enterprises, minerals being abundant in that part of the Province.

Iron Losses in d.c. Machines.

By E. HUGHES, B.Sc. (Eng.), A.M.I.E.E.

(Abstract of Paper read before the SCOTTISH CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS *at Edinburgh.)*

A LARGE amount of experimental work has been done on the measurement of rotational hysteresis loss. Practically all investigators except Hermann have found this loss to be a maximum at a flux density of about 16,000 lines per cm². Hermann employed ring-shaped stampings wound with coils carrying polyphase currents, so that the hysteresis loss measured was due to a mixture of alternating and rotating fluxes. This may account for his failure to detect any difference between rotating and alternating hysteresis losses. In spite of the fact that all the tests on rotational hysteresis appear to have been carried out on disks resembling a smooth core, many writers have applied the results thus obtained to the calculation of the iron loss in the teeth of armatures, maintaining that at high flux densities the tooth loss does not increase as rapidly as at lower densities, owing to the decrease in the hysteresis loss. It has been pointed out by Thornton that as a tooth moves from under a pole shoe "the lines of force become oblique, and midway between the poles horizontal, though the density never drops to zero. There is, therefore, a rotating magnetisation in the teeth which is at the same time fluctuating between limits" of 18,000 and 4,000 lines per cm², these values being deduced from his photographs of stream lines.

A rough estimation for a machine (particulars of which are given in the original paper), shows that for a flux density of 15,000 in a tooth tip directly under a pole, the tip density due to transverse flux when midway between the poles is reduced to at least 2,500, whilst that at the root of the tooth is reduced to a far greater extent. It, therefore, follows that the flux in the teeth approaches much more closely to an alternating than to a rotating field; and it was partly for the purpose of checking this conclusion that the experiments dealt with in the first part of this paper were undertaken.

The core loss is influenced by so many factors that it appears almost hopeless to take all of them into account; judging by the variations in the core loss of even similar machines, it seems that the value obtained from a simple expression based upon test-results is almost as reliable as that calculated by the most elaborate formula.

In Section 1 of the paper the iron loss in six d.c. machines with undistorted flux is analysed to determine:—(*a*) The effect of high flux-density upon the hysteresis loss; (*b*) the hysteresis and eddy-current exponents over a wide range of flux density; (*c*) the ranges of frequency and of flux density over which the total iron loss can be represented by an expression of the form $k_1 f^x B^y$; (*d*) the values of k_1, x and y for 0.018 in. lohys laminations; and (*e*) the agreement between values of iron loss calculated from $k_1 f^{1.5} B^2$ with the measured values over wide ranges of frequency and of flux density.

The conclusions may be briefly summarised as follows:—In a d.c. machine the hysteresis loss varies as B^x, where x lies between about 1.6 and 1.8, and the eddy-current loss varies as B^y, where y lies between about 2 and 2.4. The hysteresis loss in a toothed armature does not show any sign of decreasing with increasing flux densities of the values generally employed in d.c. armatures. Up to an apparent flux density of 23.5 kilolines/cm² at the tooth root, the hysteresis exponent remains constant over a large range of flux density; hence results obtained for rotational hysteresis loss are not applicable to armature teeth.

The eddy-current exponent is generally greater than 2, even for comparatively low flux densities, apparently mainly due to the flux distribution in the armature core becoming less uniform with increasing excitation. Above about 50 periods per second, the eddy-current loss does not continue to increase as the square of the frequency.

More consistent values of the exponents of B and f are obtained from the total iron loss than from the hysteresis and eddy-current losses separately, and the total iron loss can be calculated with fair accuracy over wide ranges of frequency and of flux density from the expression—

$W = kf^{1.5}(V_a B_a^2 + V_t B_t^2) = k_1 f^{1.5} B_a^2$ for a given armature, where B_a = flux density in armature core, and B_t = mean flux density in teeth.

The value of k for Lohys laminations, 0.018 in. thick, may be taken as 3×10^{-6} when the flux density is in kilolines/cm² and the volume in cm³. In terms of the weight in lb. of the armature core and teeth, the iron loss may be expressed as—

$W = k_2 f^{1.5}(W_a B_a^2 + W_t B_t^2)$ where $k_2 = 58.2k = 1.75 \times 10^{-4}$ for 0.018 in. lohys.

Thus for a flux density of 10 kilolines/cm² at 50 periods per second the iron loss per lb $= 1.75 \times 10^{-4} \times (50)^{1.5} \times (10)^2 = 6.18$ watts.

It is of interest to note that the makers give the loss as 1.55 watts per lb. when the laminations are tested with an alternating flux under the most favourable conditions. It may also be pointed out that the values of the core loss to be found in most textbooks on dynamo design are much smaller than those given in this paper.

In Section 2 of the paper the increase of iron loss with load is examined. The iron loss due to the commutating-pole flux is considered, and a method of calculating the iron loss for any

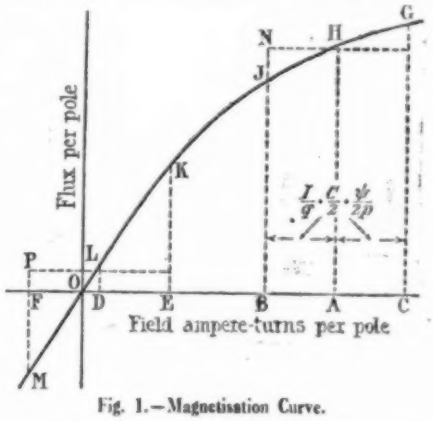


Fig. 1.—Magnetisation Curve.

degree of distortion of the main flux is suggested. The values calculated by this method are compared with those measured on a dynamo in which different degrees of distortion were obtained by means of a compensating winding, and conclusions are reached as follows:—The increase of iron loss due to a given current in the c.p. winding is independent of the flux in the main poles. The polarity of the commutating poles relatively to that of the main poles has no effect upon the loss due to the c.p. flux. The total iron loss with any degree of distortion is given fairly closely by the sum of the following losses: (*a*) Tooth loss due to c.p. flux $= W_t = kf^{1.5} B_t^2 V_t$, where k = constant derived for iron loss with undistorted field, f = frequency of machine, B_t = mean flux density in teeth

under c.p., and V_t^1 = volume of teeth subjected to c.p. flux. (*b*) When flux is not reversed at one pole-tip, tooth loss due to main-pole flux is— $W_t = kf^{1.5}B_t^2V_t$. When flux is reversed at one pole-tip, tooth loss due to main-pole flux is $= W_t = kf^{1.5}(B_t^2+B_t^2)V_t$ where k = same constant as before, V_t = total volume of teeth, B_t = mean flux density in tooth under strengthened pole-tip = (flux KE)/mean area of teeth carrying flux per pole for excitation OD (see fig. 1) and B_t = ditto under pole tip at which flux is reversed = (flux FM)/mean area of teeth carrying flux per pole for excitation OD.

(*c*) Loss in armature core = $W_a = kf^{1.5}B_a^2V_a$ where k = same constant as above, V_a = volume of armature core carrying flux, and $B_a = \Phi + 2\Phi_2/A$ where Φ = resultant flux per pole, Φ_2 = cross flux (if any) re-entering pole-shoe, and is given by ½FM(OF/FE), see fig. 1, and A = sectional area per pole of magnetic circuit through armature core. Then total iron loss = $W_c + W_t + W_a$.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

The "Non-Pong" Valve Holder.

Users of dull emitter valves, especially the 0.06-amp. type, know that such valves are sometimes irritatingly microphonic, a slight jar or vibration causing them to ring in a most unpleasant manner. In order to overcome this disadvantage, the Sterling Telephone & Electric Co., Ltd., has introduced the "Non-Pong" valve holder. In this device the holder is isolated from the outer case, the intervening space being occupied by a spongy shock absorbing material, thus tending to prevent any mechanical shock or vibration being communicated to the valve, and quiet working is ensured; moreover, accidental valve breakage is to a large extent eliminated.

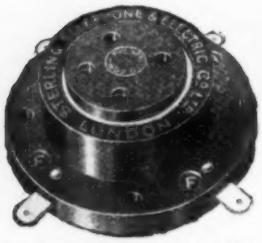


Fig. 1.—Sterling Shock-Absorbing Valve Holder.

Fig. 2.—Sterling "Non-Pong" Adaptor.

The "Non-Pong" holder can be fitted either on, or underneath, the panel and forms its own template for drilling purposes. The various sockets are brought out to soldering tags (fig. 1), so arranged that it is possible to use very short leads for plate, grid, and filament connections, thereby making for maximum efficiency. For sets fitted with the rigid conventional type of valveholder the "Non-Pong" adapter is available (fig. 2). This consists of a holder provided with valve legs to fit the ordinary valve holder, thereby gaining the advantages of shock-absorbing mounting.

An Ediswan Valveholder.

We have received a sample of the WL539 valveholder from the Edison-Swan Electric Co., Ltd. This component is guaranteed by the makers to be of genuine ebonite, and it is neatly designed to accommodate standard types of valves. As shown

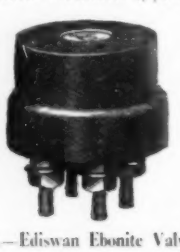


Fig. 3.—Ediswan Ebonite Valveholder.

in fig. 3, it is fitted with four screwed pins, each being provided with a pair of washers and nuts. The special feature of this holder is the fact that the brass sockets are recessed in order to prevent the user short-circuiting the filament of the valve across the high-voltage supply.

A New "Anodion" Receiver.

For those who require to listen in comfort to the local broadcasting station, the Sterling Telephone & Electric Co., Ltd., has designed a new two-valve receiver, fig. 4, so that it will efficiently operate a loud speaker at distances of from 10 to 15 miles from the station, provided that a reasonably good aerial-earth system is used; under favourable conditions the above-mentioned distance should be considerably increased. Aerial tuning and reaction are provided by means of the recently-described reaction unit, and the switching arrangement permits of tuning over a range of approximately 275-925 metres. By using appropriate reaction units the range can be extended to approximately 7,500 metres. The set is mounted in a sloping cabinet, and the new "Non-Pong" shock-absorbing valve holders (illustrated above) are fitted.

In South Africa the Radio Society is very active in arranging frequent lectures and demonstrations. One of the latter took

Fig. 4.—New Sterling "Anodion" Receiver.

place on February 27th, the idea being to establish the relative merits of representative makes of loud speakers by comparative tests. The set used for the purpose was a Sterling "Anodion" four-valve receiver, which was used without aerial or earth connections owing to nearness of the transmitting station. Some seventeen types of loud speakers were tried, and the Sterling Co. informs us that the verdict was in favour of its "Primax" (hornless) loud speaker, the mellowness and purity of tone of which was appreciated.

The C.A.V. l.f. Transformer.

It is claimed for the transformer illustrated in fig. 5, made by Messrs. C. A. Vandervell & Co., Ltd., that it is capable of a high degree of amplification which remains constant over a wide band of frequencies. This preserves the natural characteristics of the transmitted speech and music and reproduces them in good volume. The method of construction (see fig. 6),

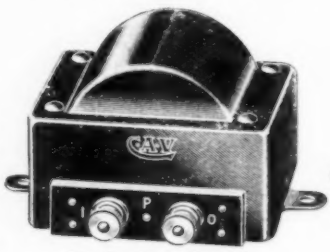


Fig. 5.—The "C.A.V." L.F. Transformer.

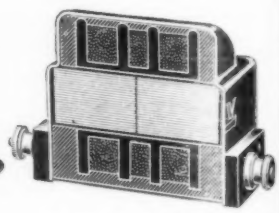


Fig. 6.—Section through the Transformer.

in which the primary and secondary windings are on separate bobbins placed side by side, ensures not only a high degree of insulation, but also low self-capacity between windings. The transformer is completely shrouded so that interaction between adjacent transformers is eliminated, and all moisture is excluded.

A Micrometer Tuning Coil Holder.

Messrs. Ward & Goldstone, Ltd., have sent us samples of their patent two- and three-coil micrometer coil-holders, the

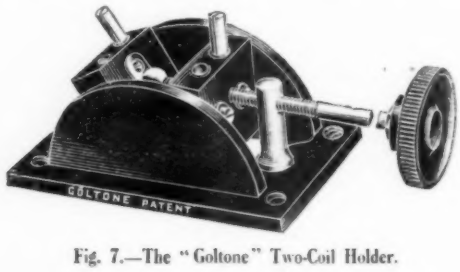


Fig. 7.—The "Goltone" Two-Coil Holder.

former of which is illustrated in fig. 7. These are of compact design and neat construction, and we have found them very suitable where fine tuning is required.

Reviews.

Radio: Beam and Broadcast. By A. H. MORSE, A.M.I.E.E. Mem.I.R.E. (New York). Pp. 192; figs. 57. London: Ernest Benn, Ltd. Price 12s. 6d. net.

Mr. Morse, who has been intimately connected from the early days with the development of commercial radio-telegraphy, especially in the United States and Canada, traces out in this book the evolution of the art for the benefit of those who may be classed as being seriously interested in the subject.

The evolution is set out mainly through a study of Patent Office records of inventions which are in use to-day, and in addition the author has given his views on future developments. In this connection it is interesting to note his opinion that "there is not yet any ground for supposing that beam transmission will ever be practicable or useful for antipodean or even long-distance communications," especially as he refers elsewhere to the Government contract of July last with the Marconi Co. for the erection of beam stations for long-distance Imperial communications. He goes so far as to say that beam signalling "is sure of rapid development, particularly for short distances," and no one will dispute that statement, but the view that beam transmission will not also prove useful for long-distance communication does seem to be very pessimistic.

The arc, as might be expected from its present extensive use at large stations, and the transmitting valve, as might be expected from its potential use at such stations, receive considerable attention, but little more than passing mention is made of the high-frequency alternator which is used at so many powerful stations throughout the world.

The first half of the book describes the growth of radio-telegraphy and telephony, year by year, finishing off with the author's views on their future lines of development, and the second half consists of an appendix which sets out 21 British and American patents describing the more important steps in the evolution of the art.

This book should be of interest and assistance to all students of the subject—a subject which we should like to think, with the author, has now reached a stage when it is "practically impossible to lie about it."

Signal Training, Vol. II, Part II, 1924: A Military Manual. Pp. 115; figs. 108. London: H.M. Stationery Office. Price 6d. net.

This is an elementary text-book on radio-telegraphy and telephony, and aims at giving officers and other ranks sufficient knowledge of the subject to understand the principles and operations of military sets, but as it deals nearly wholly with fundamental conceptions it will be welcomed by many who are outside military circles.

The book covers in outline the whole field of transmission and reception, and is able to do so in such a small space by assuming the reader to have an elementary knowledge of electrical phenomena, by avoiding mathematical explanations, and by omitting all matters of an historical nature. It is well arranged, is provided with a good index, and is written in a clear and concise manner.

For the reader, however, who is not at the same time under personal instruction, the military conciseness of the style may sometimes make the matter a little difficult to understand. But apart from this, no better book, and certainly none so good at the price, could be put in the hands of anyone who wishes to grasp the principles of modern radio-telegraphy and telephony, both from the theoretical and practical points of view, in the shortest possible time.

Your First Steps in Wireless. By HUGH S. POCOCK. Pp. 60; figs. 21. London: The Wireless Press, Limited. Price 3d. net.

Mr. Pocock, who is the editor of "The Wireless World and Radio Review," gives in this little book a well-thought-out introduction to the principles of radio broadcast reception.

The first half of the book deals broadly with the principles of wave propagation and tuning, the second half with the detection and amplification of speech, the final chapter being devoted to an explanation of the purpose of the components and controls in a simple three-valve receiver.

There must be many listeners who would like to know something of the nature of radio telephony and of how a receiving set operates, but who have no inclination to make a serious study of the subject. For these this booklet is eminently suitable. It is simple, logical, and readable, the author confining himself to what might be termed the rugged outlines of the subject.

Swoope's Lessons in Practical Electricity: An Elementary Text Book. 16th edition, rewritten, revised and enlarged by H. N. STILLMAN and E. HAUSMANN. Pp. xiii+625; figs. 488. London: Allen and Unwin, Ltd. Price 12s. 6d. net.

This book was originally written in 1900 by Mr. C. W. Swoope for the use of apprentices and others attending the Philadelphia Evening Classes in Practical Electricity. It has now been brought up to date by Messrs. Stillman and Hausmann and published in England.

The subject-matter of the first ten chapters is such as is usually found in school text books of magnetism and electricity; the succeeding thirty chapters cover a very complete course of technical electricity. The first two treat of magnets and magnetism, then follow lessons on voltaic electricity, primary cells, resistance, effects produced by the electric current, Ohm's law, and battery connections. It is evidently presumed that while working through this section of the book, the student will not only work out a number of numerical problems, but also that he is in a position to perform a fairly complete series of experiments.

The assumption in the later chapters is rather that laboratory facilities are lacking, and consequently a fuller and more descriptive treatment is adopted, amplified by a lavish use of illustrations. It is an extremely interesting, and in most cases successful, attempt to deal with the many miscellaneous applications of electricity as well as to treat adequately the various aspects of electromagnetic machinery. To cite a typical case, the lesson on electrical development of heat spreads itself over the following extensive territory: Current-carrying capacity of wires, electrical equivalent of heat, temperature coefficients, fuses, electric welding, cautery, blasting, heating and cooking, pyrometry, and it then leaves the whole subject of electric lighting to be dealt with in an equally comprehensive manner in the following chapter.

Measuring instruments are dealt with in four chapters, *viz*:—Galvanometers; Ammeters and Voltmeters; Wattmeters; and Measurement of Resistance. Then follows a chapter on accumulators and the remainder of the book deals in a most complete and satisfactory manner with the theory and practice of electromagnetic induction and its applications to telephony, dynamo-electric machinery, alternating currents and radio-signalling.

The illustrations are specially worthy of praise, and this applies both to the line diagrams and to the well chosen cuts supplied by manufacturing firms. One exception to this general excellence occurs on page 549, where a Westinghouse vibrating rectifier is illustrated. Fortunately it is described in the footnote, otherwise it might easily have been mistaken for anything in a rectangular case with a conspicuous manufacturer's label. One further criticism we would offer: the manufacturers have in our opinion been greatly over-emphasised at the expense of the really great names of the electrical profession. For example, the name of Fleming is not mentioned in connection with valves, nor Siemens and Callendar in connection with pyrometry.

This genuflection before the altar of commercialism is unworthy of the general tone of the book, which has much to commend it, including its very reasonable price.

P.H.S.K.

Connecting Induction Motors. Second Edition. By A. M. DUDLEY, B.S., in E.E. (Michigan). Pp. xiii + 361; figs. 289. London: McGraw-Hill Publishing Co., Ltd. Price 15s. net.

The title of this book is not exactly indicative of the material in its text. The first half of the book is a practical treatise on the general theory and design of induction motors, while the second half is devoted to practical methods of locating faults, mounting new coils and effecting repairs. There is a suggested train of thought, in advance of the material, throughout the book, particularly in the early pages, which will make a special appeal to the practical reader.

The diagrams of illustration are the special feature of the book, they are clear and render the author's tracings of the magnetic and electric circuits, the windings or "current bands" as the author terms them in the case of separate phase windings in the stator, very easy for the reader to follow.

The chapter dealing with *chord* and distribution factors is one which will give the practical reader a clear and speedy conception of essential points in motor design, and it is one of the additions to the first edition. The other chapters added are single-phase windings, rotor windings, magnetic balance, and windings having unequal coil groupings.

Switchgear for Electric Power Control. By E. BASIL WEDMORE, M.I.E.E., F.Inst.P., M.Am.I.E.E., and HENRY TRENCHAM, Assoc.M.Inst.C.E., A.M.I.E.E. Oxford University Press. Pp. 335 + xii; figs. 202. London: Humphrey Milford, 1924. Price 25s. net.

The authors of this book have experience in switchgear design and manufacture which is probably unrivalled in this country. Mr. Wedmore's position as Chief of the British Electrical and Allied Industries Research Association ensures that there is very little likelihood of any modern developments having escaped his notice. The reviewer, therefore, expected that a book from these authors would be of outstanding merit. He has not been disappointed.

The method of dealing with the subject seems to have been practically chronological. It starts with fusible cut-outs, then traces the development of circuit breakers from the early air break to the latest oil-immersed type. Thereafter, devices to minimise the effect of faults and to reduce stresses in insulating material due to switching, are described under the headings:—

Resistance and Reactance Switching.
Earthing the Neutral.
The Elimination of Faults between Phases.

After this comes a lengthy section on protective devices in which practically every well-known system is described and analysed. The use of current limiting reactors and the mechanical design of such apparatus are also exhaustively treated.

The concluding portion of the book deals separately with definite problems in power control such as:—Calculation of Short-circuit kVA, Small Consumers on large Systems, Mechanical and Thermal Effects of Load and Short-circuit Currents, Switchboard Arrangement, Instruments and Equipment, Out-Door Switchgear, Lightning Arresters and Surge Absorbers, Patents Applying to Protection of Electrical Systems.

The chapter on the Calculation of Short-circuit kVA, is very interesting and satisfactory, but the reviewer is of the opinion that some treatment of the subject of measurement of actual short-circuit current on large systems under working conditions should have been included.

The problem of connecting a small consumer cheaply to a large system is one of vital importance to which, so far, no solution is forthcoming. This book only gives general notes on the subject, and all the examples given are drawn from American practice. The Reyrolle switch-fuse is, in the opinion of the reviewer, one of the best attempts to solve this problem which has so far been evolved. This device might with benefit have been described and criticised.

Another important omission is any reference to the Parmiter, Hope and Sugden cartridge fuse which has at least distinct possibilities, as a rupturing device for large powers on low-pressure circuits.

The authors (in the reviewer's opinion, wisely) do not give much consideration to lightning arresting devices. There seems to be very little evidence that any such devices are really effective although, of course, British experience in such matters is decidedly limited. In this connection it is interesting to recall the fact that the eminent Italian engineer, Dr. Semenza, made an analysis of the power systems of Italy to determine the value of the protective apparatus in use. He found the number of devices used varied from none to seventeen per circuit. He was unable to find that the unprotected circuits were any worse than the others.

The reviewer has only noted one error in the book. This occurs on page 12, where the Sparklet fuse is alleged to contain carbolic acid. This should read carbonic acid.

The printers have done their work well, but the authors have drawn too liberally from the pages of manufacturers' catalogues for their illustrations to meet with the full approval of the reviewer. It is only fair, however, to state that they have made due acknowledgment throughout.

The book is sincerely recommended to all power station engineers.

Humanism and Technology. By Principal C. GRANT ROBERTSON, Sir THOMAS H. HOLLAND, Professor C. H. DESCH, Sir HENRY FOWLER, Professor F. W. BURSTALL, and Professor W. CRAMP. Pp. 91. Oxford University Press. Price 3s. 6d. net.

The book consists of six illuminating essays, which were delivered as special lectures to a vacation school for engineering teachers at Birmingham and Oxford in 1923. The essays, *viz.*:—Humanism and Science, Humanism in Technical Education, The Place of the Humanities in Education, Subjects off the Syllabus, Education in Applied Science, and New Fundamental Ideas in Science, are not designed as purely educational in the strict sense of the word as applied to teachers, but rather in a very broad manner which will make an appeal to all persons of progressive mind. They are most elevating, and written with a simplicity which adds to their great interest.

Marketing the Technical Product. By ERIC N. SIMONS. Pp. 200 + xi; figs. 8. Manchester: Emmott & Co., Ltd. Price 7s. 6d. net.

Industry exists not to supply profits, but to supply goods to consumers. It is upon this principle that the author deals in a scientific manner with the successful distribution of a successful technical production.

The importance of preliminary organisation is probably not fully realised by many and the author evidently recognises this. He deals with the question of organisation in an extensive manner, before embarking on the sales campaign through the many avenues of advertising to the sale of the article.

The much discussed question of technical salesman for technical products, is introduced in chapters on salesmen, and the author puts forward some valuable suggestions in support of the necessity of helping the salesman.

The chapter on advertising is the special feature of the book and is probably unique in that it commences with arguments against advertising, emphasising that advertising is not always advantageous, and can prevent a sale if not carried out in a careful and scientific manner.

The author gives the principles upon which successful advertising must be designed; these can, broadly speaking, be reduced to simplicity and truth. He points out the necessity of advertising the technical product in a technical manner, and invents "the advertising unit system," the principle of which is to award points for each reply in accordance with its relative value, the replies ranging from the director down to the catalogue-hunter of a firm with respective values of 6 to nil.

In the chapter "The Engineering Catalogue," the author deals with the necessity of giving useful information in catalogues, and many practical suggestions are given in connection with exhibiting. The book concludes with a treatise on over-sea marketing.

The book should be of great value to all interested in salesmanship and the marketing of technical products.

Industrial Conflict. By the Rt. Hon. GEORGE N. BARNES. Pp. 100 + xi. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d. net.

That industrial conflict should be avoided is the view of every sober-minded person. The author speaks with authority on the question of labour organisation and his exposition of many of the schemes designed to maintain peace in the industrial world makes deeply interesting reading. He deals with the labour problems within our own shores and abroad and leads up to the international problem with a description of the work that is being done in this direction.

The book is one which all who look forward to smooth industrial relationships will welcome.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

29,579. "Vibration responsive devices." Western Electric Co., Ltd. (Western Electric Co. Inc.). November 23rd, 1923. (231,216.)

31,745. "Vacuum electric tube devices." E. Y. Robinson. December 18th, 1923. (231,225.)

32,027. "Electrical switches and operating mechanisms (therefor)." F. B. Cox. December 21st, 1923. (231,227.)

32,411. Circuit arrangements for selectors in automatic telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. December 24th, 1923. (231,237.)

32,554. "Electric connection fittings." W. Fairweather (Sligo Manufacturing Co.). December 31st, 1923. (231,243.)

1924.

163. "Means for utilising electromagnetic radiation and atmospheric electricity for transmitting and generating power." S. Gelambi. January 3rd, 1924. (231,247.)

779. "Speed regulator for maintaining prime movers, and more particularly high-frequency machines, at a constant speed." C. Laurence Mkt. Gen. January 13th, 1923. (209,752.)

896. "Brush holders for electrical apparatus." C. S. Martin and A. G. Briant. January 11th, 1924. (231,257.)

1,080. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. January 14th, 1924. (Cognate application 16,142/24.) (231,269.)

2,887. "Electric arc cutting." C. J. Bird, H. E. C. Wade, and P. Jackson. February 4th, 1924. (231,278.)

2,973. "Electric couplings, terminals, and the like." L. H. Wadsworth. February 5th, 1924. (231,280.)

3,143. "Prepayment electricity meters." Chamberlain & Hookham, Ltd., and S. James. February 6th, 1924. (231,282.)

3,410. "Electric switches." J. A. Crabtree. February 9th, 1924. (Addition to 201,978.) (231,286.)

3,917. "Electric conductors." St. Helens Cable & Rubber Co., Ltd., and J. H. C. Brooking. February 15th, 1924. (231,289.)

4,392. "Electric connectors." British Thomson-Houston Co., Ltd. February 21st, 1923. (211,875.)

4,688. "Lighthouse and other illuminating apparatus." Chance Bros. and Co., Ltd., and H. O. Wraith. February 23rd, 1924. (231,297.)

4,655. "Duplex bridge systems of telegraphy." J. H. Smart. March 5th, 1924. (231,304.)

5,865. "Impulse-counting devices for use in telephone systems." Relay Automatic Telephone Co., Ltd., and F. M. Ward. March 7th, 1924. (231,365.)

8,135. "System of electric distribution." British Thomson-Houston Co., Ltd. May 22nd, 1923. (216,495.)

9,261. "Sound-reproducing apparatus." Marconi's Wireless Telegraph Co., Ltd. April 13th, 1923. (214,265.)

9,561. "Automatic reclosing electric circuit-interrupter systems." Metropolitan-Vickers Electrical Co., Ltd. April 16th, 1923. (214,626.)

10,354. "Telephone systems employing selecting devices." Siemens Bros. and Co., Ltd., W. G. Patterson, and D. A. Christian. April 20th, 1924. (Addition to 203,759.) (231,335.)

11,740. "Releasing mechanism for coin-controlled meters for gas, water, electricity, or the like." H. P. A. Mortensen. May 12th, 1924. (Convention date not granted.) (215,791.)

13,217. "Electrically-heated percolators." British Thomson-Houston Co., Ltd. July 6th, 1923. (218,631.)

13,399. "Appliance for testing electrical energy and sparking-plugs under pressure." F. Ball. May 31st, 1924. (231,350.)

13,759. "Systems of electric lighting." E. L. Terrey, J. E. Savidge, L. Farmer, H. L. Farmer, and H. L. Farmer. August 28th, 1924. (231,351.)

15,368. "Holders for thermionic valves." Rodo Patents, Ltd., and F. A. L. Sloot. June 25th, 1924. (231,359.)

15,585. "High-vacuum pumping systems." General Electric Co., Ltd., and N. R. Campbell. June 28th, 1924. (231,360.)

15,935. "Aerial systems for receiving radio signals." Soc. Française Radio-electrique. July 2nd, 1923. (218,661.)

15,999. "Thermo-electric generators or the like." Sabin Electrical Products Corporation. July 19th, 1923. (219,296.)

17,527. "Vehicle-carried indicators for use in electric traction systems." R. Haddan (J. B. Regan). July 22nd, 1924. (231,373.)

17,921. "Electric steering apparatus." Siemens Schuckertwerke Ges. May 2nd, 1924. (231,377.)

19,224. "Tanks for electrical or other apparatus." Metropolit.-Vickers Electrical Co., Ltd. August 30th, 1923. (221,201.)

19,875. "Electric furnaces." T. F. Baily. August 28th, 1923. (221,306.)

20,383. "Telephone receivers." Neufeldt & Kuhnke. November 30th, 1923. (225,514.)

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516. "Electric gas-purifying plants." Siemens Schuckertwerke Ges. January 9th, 1924. (227,450.)

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2,031. "Vibration responsive devices." Western Electric Co., Ltd. (Western Electric Co. Inc.). November 23rd, 1923. (Divided application on 29,579/23.) (231,410.)